Environmental Monitoring Plan (Final)

Development of a Coal Quality Expert

U.S. Department of Energy
Pittsburgh Energy Technology Center
Pittsburgh, Pennsylvania

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
B & V	Black and Veatch
B & W	Babcock and Wilcox
Btu	British thermal unit
CCT	Clean Coal Technology
CE	Combustion Engineering
CQ	Coal quality
CQE	Coal Quality Expert
CQDC	Coal Quality Development Center
CQIM	Coal Quality Impact Model
CQIS	Coal Quality Information System
DOE	Department of Energy
EES	Expert-Ease Systems, Inc.
EIV	Environmental Information Volume
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
EPT	Electric Power Technologies, Inc.
ESP	electrostatic precipitator
FGD	flue gas desulfurization
FPT	Fireside Performance Test Laboratory
FTG	field testing guidelines
GADS	Generating Availability Data System
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NYSEG	New York State Electric and Gas Co.
PM	particulate matter
PON	program opportunity notice
PSO	Public Service Company of Oklahoma

QA/QC	Quality Assurance/Quality Control
RETROFGD	Retrofit Flue Gas Desulfurization
SEGCO	Southern Electric Generating Company
UNDEMRC	University of North Dakota's Energy and Mineral Research Center

1.0 INTRODUCTION

As a Clean Coal Technology project, the Coal Quality Expert Project--cosponsored by the Electric Power Research Institute (EPRI) and Combustion-Engineering (C-E)--is subject to the compliance procedures of the Department of Energy (DOE). One of these requirements, specified in the Cooperative Agreement between DOE and EPRI/C-E, is the development and implementation of an approved Environmental Monitoring Plan (EMP). The EMP is provided in this document.

1.1 Purposes of EMP

The purposes of the EMP are to:

- Document the extent of compliance monitoring activities (i.e., those monitoring activities conducted to meet permit requirements);

- Confirm the specific environmental impacts predicted in the *National Environmental Policy Act documentation*[1]; and

- Establish an information base for the assessment of the environmental performance of the technology demonstrated by the project.

The EMP contains two types of monitoring activities: compliance and supplemental. Compliance monitoring (first bullet) involves monitoring of various gaseous, aqueous, and solid waste streams currently or expected to be required to meet existing permit conditions or regulations by federal, state or local governmental agencies.

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[1]For this project, the NEPA documentation is based upon the revised final Environmental Information Volume, produced by Radian for EPRI on 2/23/90.

Supplemental monitoring (second two bullets) would provide environmental and process data not provided by compliance monitoring. Data obtained from supplemental monitoring will allow DOE to evaluate the environmental performance of the technology and to asses the potential environmental constraints and/or beneficial aspects of the technology.

1.2 EMP Scope

This EMP specifies the streams to be monitored, the parameters to be measured, the species to be analyzed, and health and safety aspects to be monitored. The monitoring would be either compliance or supplemental and would include source (gaseous, aqueous, and solid waste and by-product streams), health and safety, and process and operating conditions monitoring. The duration and frequency of the monitoring activities will be specified, as well as the timing for the monitoring activities.

Project of this nature typically involve the following four activities: construction, pre-operational baseline, operational, and post-operational. This project will involve only the pre-operational and operational activities. Since no construction is associated with this project, no construction monitoring is required. After the project, all sites will be returned to pre-project operations. Therefore, no post-operational monitoring is required.

This project consists of coal characterization and cleanability studies, laboratory fuel characterization, pilot-scale combustion testing, and full-scale combustion testing (see Section 2.0). No monitoring would be required for coal characterization and cleanability studies or laboratory fuel characterization since the proposed testing is at a scale routinely conducted at these facilities. Also, these test facilities are research related, do not require any environmental permits, produce fairly insignificant emissions, and do not represent a threat to human health and the environment.

This EMP will discuss both pilot-scale and full-scale combustion testing; however, the emphasis will be on the full-scale combustion testing because emissions from the pilot-scale facilities are relatively minor.

Pilot-scale monitoring relative to environmental concerns addressed in this EMP will consist only of compliance monitoring. However, the technical goals of this project require extensive pilot-scale process and operating conditions monitoring beyond that required for compliance purposes.

Both compliance and supplemental monitoring would be required for the full-scale combustion tests. Each of these tests would involve pre-operational (baseline) and operational (improved quality) parts. The baseline test burn will involve combustion testing with a coal or blend of coals typical of those used at the power station while the station is operating at or below required air emission levels. The improved quality test burn will involve combustion testing with a coal or blend of coals lower in sulfur content than that used for the baseline test burn. Therefore, air emissions would be unchanged during the baseline test burn and reduced during the improved quality test burn.

1.3 Report Organization

The organization of this report was prepared under guidance from DOE. Section 2.0 of this EMP describes the Coal Quality Expert Clean Coal Technology Project. Section 3.0 describes the existing environment of the sites involved in the demonstration aspects of the project (i.e., the electric utility field testing). Section 4.0 discusses the compliance monitoring required. Section 5.0 addresses supplemental monitoring. An integrated monitoring schedule (i.e., compliance and supplemental) is presented in Section 6.0. Section 7.0 discusses how the data are gathered, compiled, and reported. Section 8.0 contains the references. Finally, Section 9.0 contains the quality assurance plan.

2.0 PROJECT DESCRIPTION

The purpose of this section is to describe the activities, processes, and the schedule for the Coal Quality Expert project.

The objective of the project is to develop a computer-based analytical program that will enable electric utilities to select the best quality fuels based on specific federal, state, and local environmental requirements and costs. The program,called the Coal Quality Expert (CQE), will combine and upgrade several existing computerized models and will add an expert system. The goal is to improve the cost effectiveness of reducing the emissions of sulfur oxides (SO_x), particulate matter, and other pollutants. The development of the CQE involves several tasks conducted by a variety of participants at multiple sites.

2.1 Description of Project

The Coal Quality Expert Development Project consists of two phases: (1) testing and data gathering, which involves optimization of coal quality for combustion in different types of power stations; and (2) the development of an expert system--a computer program that can emulate human reasoning in a specified area of knowledge. The expert system for this project would be designed to enable coal-burning utilities to select the best quality coal for a given power station in relationship to economic considerations and to federal, state, and local environmental requirements. Because this activity is a data acquisition and computer-based exercise, it would not impact or affect the human environment; therefore, it is not addressed in the EMP.

The focus of this EMP is on the proposed actions to be undertaken in the testing and data gathering activities. A description of each of the testing and data gathering activities and the sites where each of these activities will be conducted is presented in the following paragraphs.

2.1.1 Coal Characterization and Cleanability Studies

Coal cleanability characterization is designed to reduce the cost of electric power generation by informing coal suppliers and coal consumers of the response and behavior of specific coals to physical coal cleaning. This characterization goes beyond the traditional method of predicting cleaning behavior on the basis of washability analyses of small samples. Coal characterization and cleanability studies[1] will be performed on samples ranging from 500 to 1,000 tons. Coal cleaned in these activities will be used in the combustion testing. As previously discussed, existing facilities, specifically permitted and designed for these activities, will perform these activities.

Coal characterization will entail an extensive and thorough laboratory appraisal of the relationship between coal quality and the physical properties of size, density, and (in some cases) surface characteristics. The size-quality relationship will be defined by laboratory screening followed by analysis of the various size fractions and the density-quality relationship by a float/sink test involving separation of coal into density fractions using liquids of known density followed by analysis of the various density fractions. Depending on the coal type and rank, laboratory froth flotation tests may be conducted on the raw coal fines to define the surface characteristics-quality relationship. The purposes of determining the raw coal characteristics will be to understand the coal's cleaning characteristics including the potential for SO_2 emission reduction and the distribution of coal and impurities among size and density fractions.

A sample of raw coal as large as seven tons, depending on the coal's topsize, will be extracted by an automatic sampler as the 500- to 1000-ton coal shipment is received at the CQDC. A portion of this sample (2½ tons

[1] Cleanability studies, as presented in this document, consist of impurities liberation investigations and coal cleaning evaluations.

if the coal is 6-inch topsize) will be used for raw coal analyses and the rest for liberation tests. The sample will be analyzed by the laboratory for:

- Moisture;
- Proximate Analysis;
- Sulfur Forms;
- Heating Value;
- Ultimate Analysis;
- Size Consist;
- Float/Sink Analyses;
- Hardgrove Grindability;
- Ash Fusion Temperatures (Red, Oxd);
- Ash Composition;
- Chlorine Content; and
- Gravity Fractionation.

Impurities Liberation Investigation will determine the extent to which crushing liberates additional ash and sulfur-containing mineral pyrite from a coal. "Raw coal" is a general term that includes both the valuable energy-rich portion of the geological formation called coal and the portions that are impurities. The impurities in raw coal are the noncombustible portions, such as sulfur and the minerals that form ash.

Liberation is the process of breaking raw coal particles in the hope that some free mineral matter (which includes pyrite) fragments will be formed when locked particles are fractured. Along with fracturing locked particles, many other particles, containing solely inherent ash or already classified as free mineral matter, are broken. Breaking these types of particles changes the raw coal's particle size distribution but it does not increase the amount of liberated impurities in the coal. The purpose of the CQDC investigation of the raw coal's impurity liberation potential will be to ascertain if additional impurities are freed by crushing the raw coal. If additional impurities can be liberated, then the least amount of size reduction that will bring about some desired increase of the liberated impurities quantities must be determined.

The liberation testing method is as follows: A 10,500 lb split of the raw-coal sample will be reduced in a roll crusher to 1 1/2-in topsize. And 3,500 lb splits of the crushed 1 1/2-in x 0 raw coal will then be reduced in a roll crusher to 3/4-in and 3/8-in topsizes, respectively. One hundred and ten pounds will be split from the crushed 3/8-in x 0 raw coal and reduced to 28M x 0 raw coal. A split of the 28M x 0 crushed coal will be further reduced to 100 mesh topsize in a Holmes mill. The original and five reduced size coal samples will be screened to determine their size distributions and the resulting size fractions subjected to laboratory float/sink analyses.

Coal cleaning evaluation will focus on a coal's susceptibility to cleaning. Coal will be treated by various methods in commercial-scale equipment. The combustion characteristics of the coal before and after cleaning will be analyzed and compared. Coal cleaning tests will be the major activity at CQDC. These tests will involve the use of commercial-size equipment.

Plant testing eliminates problems of scale in laboratory or even pilot-scale testing. For example, if a cyclone test is performed using a small diameter cyclone in a laboratory, some parameters such as particle size of the feed can be scaled down. However, other factors such as the acceleration of gravity or the viscosity of water cannot be scaled. Even the reduction of feed particle size is suspect because increased liberation caused by grinding may greatly change the density distribution of the coal.

Coal cleaning tests will serve both general and particular objectives. They will be used to confirm predictive techniques, to solve particular problems, and to demonstrate performance. The primary test objective will be to provide C-E or B&W with 15 to 20-ton representative samples of a medium-cleaned coal and a deep-cleaned coal for combustion characterization. Other test objectives will be to:

- Demonstrate coal cleanability;
- Trace the general movement of coal throughout the cleaning plant;
- Develop design parameters for new plants, or retrofit circuits for existing plants;
- Determine if any special problems exist in cleaning particular coals;
- Develop methods to improve unit operations; and

- Develop capital and operating cost estimates for commercial coal cleaning plants.

The Coal Quality Development Center, which is capable of simulating many commercial coal cleaning flowsheets, offers a unique opportunity to construct flowsheets to optimize yield and heating-value recovery at a given quality. The CQDC is capable of processing 10 to 20 tons/hour at 1/4 to 3/4 inch topsize, respectively. The main gravimetric separatory and flotation equipment used at the CQDC are the:

- Heavy-media cyclone;
- Concentrating table;
- Two-stage, water-only cyclones; and
- Froth flotation cells.

2.1.2 Laboratory Fuel Characterization

Laboratory Fuel Characterization will establish the important coal properties that can be used to reliably predict the combustion and fireside performance behavior of both baseline and improved quality coals. ASTM analyses, specialty tests, and advanced analytical techniques will be performed to provide a detailed characterization of the test coals.

In support of C-E, the University of North Dakota's Energy and Mineral Research Center (UNDEMRC) will conduct crucible-size testing in an existing research laboratory using routine procedures and equipment, i.e., a few pounds of coal to be tested. C-E's drop tube furnace system (DTFS) will be used to determine coal devolatilization yields, nitrogen release efficiencies, and char combustion kinetic parameters. These research laboratories are specifically designed for these activities, are currently in operation, and only combust small quantities (i.e., a few pounds per hour) of coal. For these reasons, additional investigations into the capabilities and limitations of these facilities to evaluate possible environmental impacts is unwarranted.

The coal property data generated under this activity will be used in developing correlations with performance measured during pilot-scale and field tests, and will serve as basic information for combustion calculations during model development and validation.

2.1.3 Pilot-scale Combustion Testing

Pilot-scale tests on larger volumes of coal (up to 20 tons each of 23 of the 26 test coals) would be conducted in C-E's Fireside Performance Test Facility and B&W's Small Boiler Simulator (20 test coals in the former, 3 in the latter) to evaluate coal properties that influence boiler design and operating factors. The scale of the proposed pilot-scale tests would be approximately the same as testing currently conducted at the C-E and B&W facilities.

2.1.4 Full-scale Combustion Testing

Field test burns of baseline and improved quality coals[2] would be conducted at six coal-burning utilities. The field test burns would provide operating data necessary for an evaluation of the applicability and accuracy of the CQIM and EPRI's Fireside Testing Guidelines and would confirm the results of the laboratory tests. Each field test burn would be conducted for a period of two months. During the first month, the coal-burning utility would burn a coal or blend of coals typical of those it currently uses as fuel; during the second month, an improved quality coal would be burned. Except for the temporary installation of test ports, monitoring equipment, and sampling instrumentation, no new construction or alteration of the coal-burning utilities would be required.

At four coal-burning utilities, a single generating unit would be involved in the full-scale combustion testing. The name, size, and location of each unit are as follows:

- Watson, Unit 4 (250 MW), Gulfport, MS;
- Gaston, Unit 5 (880 MW), Wilsonville, AL;
- Northeastern, Unit 4 (445 MW), Oologah, OK; and
- Homer City, Unit 2 (600 MW), Homer City, PA.

The other two coal-fired plants have only one generating unit. These are:

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[2]As used in this report, "baseline coal" means a typical coal used in a given power station when that station is operating at or below its current sulfur dioxide emission limits. "Improved quality coal" means coal that is significantly lower in sulfur dioxide emissions than baseline coal.

- King (560 MW), Oak Park Heights, MN; and
- Cheswick (500 MW), Springdale, PA.

Baseline coal for Gaston, Watson, Northeastern, and King Stations would be a normal blend of two or more coals from existing on-site coal storage. Blending of coals is a common practice at coal-fired utilities because there are generally several coals of varying quality in on-site storage. The improved quality coal for these four stations would be produced by using a larger quantity of low-sulfur coals in blending, thereby producing a blend of lower sulfur coal than the baseline coal.

Baseline and improved quality coals for the Cheswick and Homer City Stations would be a cleaned coal from the coal cleaning plant which is owned by the utility operating each station. The Cheswick Station receives cleaned coal from the Warwick Coal Cleaning Plant in Greene County, Pennsylvania, and the Homer City Station receives cleaned coal from the Iselin Coal Cleaning Plant in Indiana County, Pennsylvania, which is adjacent to Homer City Station.

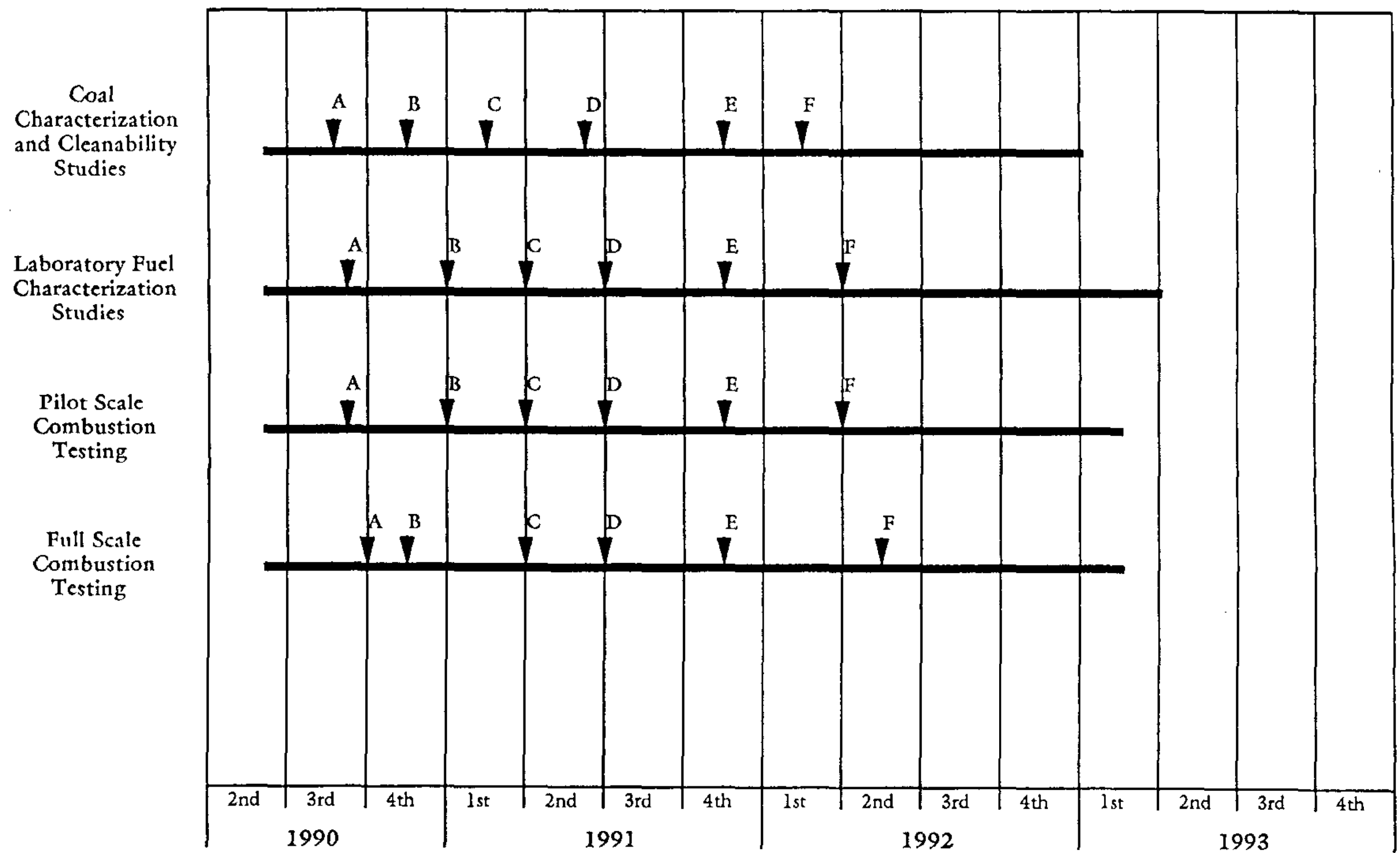
2.2 Modification of Existing Facilities

Except for the temporary installation of test ports, monitoring equipment, and sampling instrumentation, no new construction or alteration would be required at any of the previously noted facilities.

2.3 Project Schedule

A schedule of the pilot-scale and full-scale combustion testing and data gathering activities is shown in Figure 2-1. Each of the Coal Characterization and Cleanability Studies milestones shown in Figure 2-1 involves a 30-day period with most of the activity occurring at the CQDC in Homer City. Each of the laboratory fuel characterization milestones will involve 3-4 weeks of activity at the University of North Dakota Energy and Mineral Center at Grand Forks, North Dakota. Pilot-scale milestones involve 3-4 weeks of activity occurring at C-E's Kreisinger Development Laboratory in Windsor, Connecticut and Babcock and Wilcox's (B&W) Alliance Research Center in Alliance, Ohio. Full-scale combustion testing milestones involve a maximum of 60 days of testing (30 days on baseline coal and 30 days on improved quality coal) at each of the six utility sites shown at the bottom of the figure. The

REVISED CQE PROJECT SCHEDULE



▼ Completed Test Runs or Major Milestone

Testing Associated With:

A - Northeastern Station
B - Gaston Station
C - Watson Station
D - King Station
E - Cheswick Station
F - Homer City Station

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first full-scale combustion test is scheduled to begin during the third quarter of 1990; the last field test is scheduled to be completed in late 1993.

2.4 Emissions and Discharges From the Project

This section focuses on the only two parameters likely to be affected during the operational phase -- air quality (specifically, changes in sulfur dioxide emissions) and solids production (specifically, changes in ash production). These changes will be of short duration (i.e., 30 days or less) and predominantly positive (i.e, decrease in SO_2 emissions and in quantity of ash produced). Other parameters of environmental concern are either anticipated to be unaffected or cannot be readily calculated.

2.4.1 Atmospheric Emissions and Controls

Calculations of changes in SO_2 emissions are based on the sulfur content (weight percent) and heating value of the normal and test coals. Comparisons were made in terms of lb/MBTU of SO_2. The calculations assume that 100 percent of the sulfur in the coal is emitted as SO_2. Actual values may be significantly lower (5 percent or more) depending on the amount of sulfur retained in the bottom and fly ash. No flue gas desulfurization (FGD) processes are in operation at any of the six electric utility sites.

Based on 1988 figures, the following annual percent changes in SO_2 production are expected at each plant site as a result of the two 30-day test burns:

Plant	Annualized Percent Change in SO_2 Production
Watson	- 2
Gaston	- <1
Northeastern	- <1
King	2
Homer City	- 1
Cheswick	- 1

The largest decreases in plant SO_2 production, roughly two percent for the year, should occur at Plants Watson and King. The expected decrease at Plant Watson is due to a unit representing only one-third of the plant's total emissions. During the improved quality test, SO_2 emissions from this individual test unit are expected to decrease by roughly 70 percent. Decreases for the other individual test units during the 30-day improved quality test are as follows: Gaston (25 percent), Northeastern (5 percent), King (25 percent), Homer City (50 percent), and Cheswick (20 percent).

2.4.2 Aqueous Discharges and Controls

Wastewater is treated by a variety of methods before being discharged into the environment. Since no changes in the hydraulic loading to the treatment systems are expected, there should be no significant changes in water use or in the quality of the wastewater discharges. For these reasons, no supplemental monitoring of these streams warrant inclusion in the EMP.

2.4.3 Solid Waste/By-Product Generation

The primary solid waste produced by utilities is residual coal ash after burning. This residual ash is collected as fly ash and bottom ash. The potential for change in ash production is evaluated in the same manner as SO_2 emissions. That is, calculations of changes in ash production were based on the ash content of the normal and test coals in terms of lb/MBTU of ash.

Based on 1988 figures, the following annual percent changes in ash production are expected at each plant site as a result of the two 30-day test burns:

Plant	Annualized Percent Change in Ash Production
Watson	- 1
Gaston	+ <1
Northeastern	- <1
King	- <1
Homer City	- 2
Cheswick	- 3

The most notable percentage decrease in ash production should occur at Homer City and Cheswick. During the 30-day improved quality test at Homer City, ash production is expected to decline by nearly 20,000 tons. The decrease at Cheswick during the improved quality test may be as high as 8,000 tons. All other changes during the proposed test burns, both baseline and improved quality, are expected to be indistinguishable in comparison to the normal fluctuations in operating conditions encountered by utilities.

3.0 EXISTING ENVIRONMENT

The six electric utility sites (and associated coal cleaning plants) where the demonstration aspects of this project will be conducted are shown in Figure 3-1. The six plants are: Plant Watson, Mississippi; Plant Gaston, Alabama; Plant Northeastern, Oklahoma; Plant King, Minnesota; Homer City Plant, Pennsylvania; and Cheswick Plant, Pennsylvania. Relevant climate, land use, environmental, socioeconomic, and cultural features of these sites (including the coal cleaning plants that will be involved in this project) and the surrounding areas are described in more detail in the Environmental Information Volume (EIV). Following is a summary of relevant information drawn from the EIV. Site descriptions of the two pilot plant testing locations are provided in Section 3.7.

3.1 Plant Watson, Mississippi Site

This plant is located in Gulfport, Harrison County, on the Gulf Coast. Plant Watson is bordered on the north by Interstate Highway 10 and on the east by the Biloxi River. To the west and south the land is used for industry. To the north the land is mostly undeveloped; east of the river are some residences. The climate is moist and semi-tropical with prevailing southerly winds.

The area is in attainment with National Ambient Air Quality Standards (NAAQS). Plant Watson has had no significant compliance problems meeting state or federal emission limits.

Plant Watson draws its water from the Biloxi River and discharges low-volume waste into Big Lake, which are classified by the state as suitable for the propagation of fish and wildlife and for recreational use. The plant has a good compliance record, except for an occasional exceedance of the pH limit. Most of the groundwater in Harrison County comes from the Citronelle

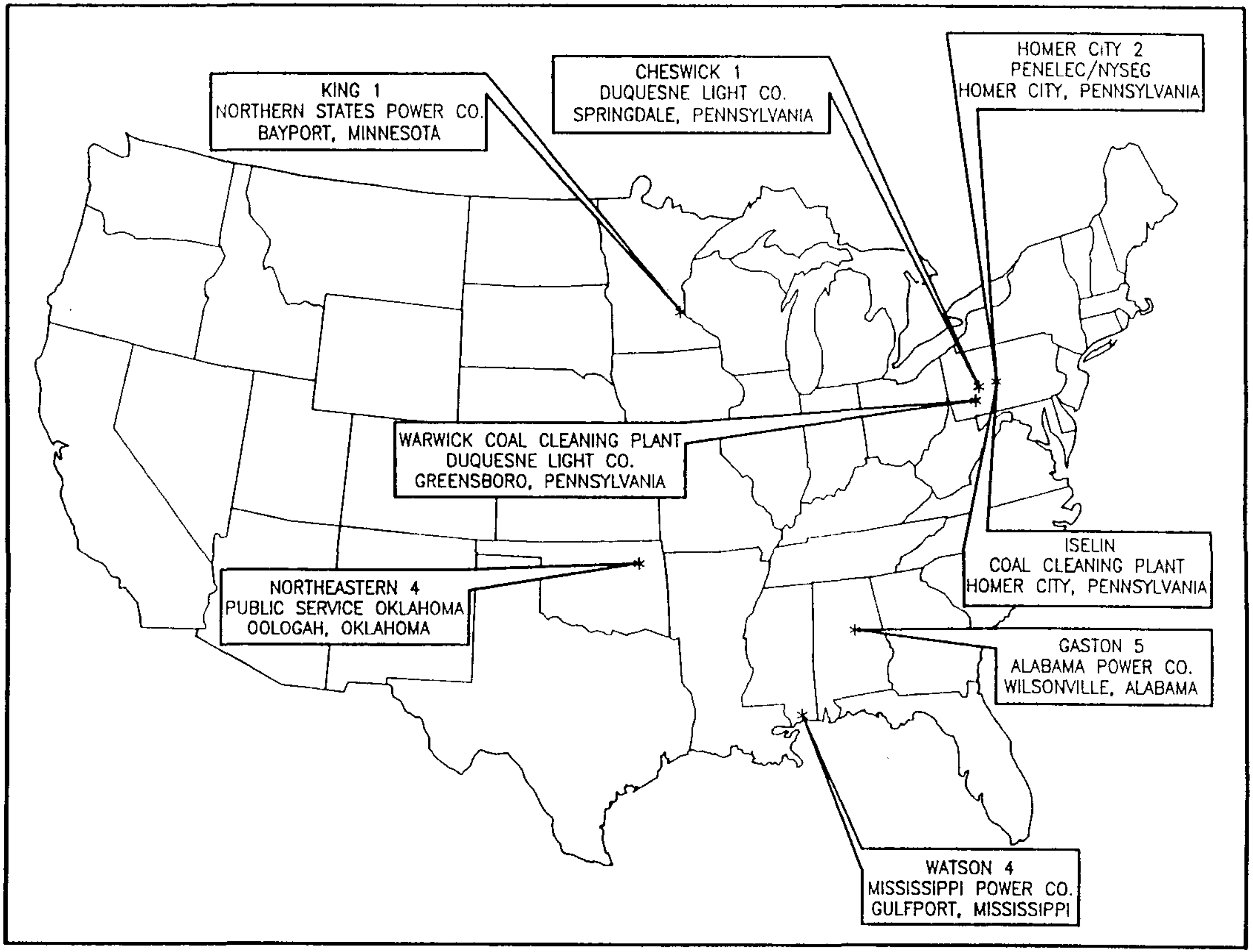

Figure 3-1. Site Map

aquifers, which supply shallow domestic wells and some municipal wells. The water quality is fair, with some contamination by seawater along the Gulf Coast and also from landfills in old gravel pits, industrial runoff, etc. The pH is acidic and iron content is high. The site of this project is located above the 100-year old floodplain.

Endangered or threatened species found in the area include the following: bald eagle; red-cockaded woodpecker; brown pelican; peregrine falcon; gopher tortoise; black pine snake; southern hog-nosed snake; eastern indigo snake; and Atlantic sturgeon. No wetlands will be affected by this project.

Population growth in Harrison County (1986 population: 172,600) has been twice that of the state as a whole and slightly higher than the U.S. average. The unemployment rate is lower than for the State of Mississippi as a whole, but higher than the U.S. average.

3.2 Plant Gaston, Alabama Site

This plant is located outside of Wilsonville, Shelby County in central Alabama. Plant Gaston is bounded on the north and east by Yellowleaf Creek and to the east and south by the Coosa River. Agricultural lands lie to the west and also above Yellowleaf Creek. The climate is temperate to semi-tropical. Winds in the summer are generally from the south; in the winter, from the north.

Shelby County is in attainment with NAAQS. Since neighboring Jefferson County (Birmingham), however, is not in attainment with the ozone standard because of auto and industrial emissions, Shelby County may be redesignated as nonattainment for ozone. Plant Gaston has had no significant compliance problems.

Plant Gaston draws its water from and discharges into the Coosa River, which is classified by the state as suitable for the propagation of fish and wildlife, public water supply, swimming and other whole body contact sports. The plant has experienced no significant problems complying with its NPDES permit. Groundwater in the area is affected by the complex geology (faulting). The site of this project is located above the 100-year flood-plain.

Talladega National Forest (Talladega and Shoal Creek districts) lies directly east and northeast of Wilsonville in Talladega and other counties. A number of rare plant species occur there and in the Ridge and Valley Province, but not on plant property. No wetlands will be affected by the proposed project.

Population growth in Shelby County (1986 population: 81,200) exceeds that of both the U.S. and Alabama. The unemployment rate is slightly higher than the U.S. average but less than that of the state as a whole.

No sites in the general vicinity are listed in the National Register of Historic Places, but seven archaeological sites are within a 3-mile radius of the plant.

3.3 Northeastern Plant, Oklahoma Site

This plant is located south of Oologah, in Rogers County, northeastern Oklahoma. This region of northeastern Oklahoma is primarily rural. Tulsa is the largest city in the region. Forty to fifty percent of the area is in cropland, pasture, and woodland. The area is characterized by a continental climate with long, occasionally very hot summers. Prevailing winds are southerly, except for northerly in the winter.

Rogers County, where the plant is located, is in attainment with the NAAQS. Since neighboring Tulsa County, however, is not in attainment for ozone, Rogers County may be redesignated as a nonattainment area for ozone. The plant has had no significant compliance problems with either federal or state air quality regulations.

The Northeastern Plant draws its water from Lake Oologah and discharges into the Verdigris River. The lake, which serves as a constant water source, is classified for drinking water, recreational, aesthetic, and agricultural use. The quality of the Verdigris River is good at the plant site, but decreases further downstream. The Northeastern Plant has had no major problems complying with its water permits.

Groundwater in the area has been adversely affected by acid drainage from local lead and zinc mines. The plant site where the project will be conducted is above the 100-year floodplain.

The Oologah game management area around the lake is managed primarily for white tail deer, bobwhite quail, cotton tail rabbit, racoon, and fox and gray squirrel. No endangered or threatened species are known to exist on the plant site, although bald eagles and white pelicans are protected in the lake area. Although significant wetlands are in the area, no wetlands are present where the project activities will be conducted.

The population growth of Rogers County (1986 population: 59,700) is more than twice that of the U.S. and the State of Oklahoma. The unemployment rate is higher than both the U.S. and state averages.

No Indian mounds or other archaeological sites are located on plant property, though there is a famous one in nearby Claremore. The birthplace of Will Rogers, which is four miles northeast of Oologah, is on the National Register of Historic Places.

3.4 Plant King, Minnesota Site

This plant is located in Bayport, Washington County, on the St. Croix River just northeast of St. Paul. Although the plant is located in a major industrial area, within 1/5 to 1/4 mile from the plant boundary is a residential area. The climate is continental, with occasional periods of heat in summer and longer arctic outbreaks in the cold season. Winds are predominantly from the southeast in the summer and from the northwest in the winter.

The area is in attainment with the NAAQS. Plant King has had no major problems complying with state or federal air quality standards.

Plant King draws its water from and discharges into the St. Croix River, which is a National Wild and Scenic River protected for fisheries, recreation, and drinking water. Plant King has had no recent problems complying with its NPDES permit. The source of groundwater in the area is primarily from the Jordan aquifer, and the water quality is generally good. The site of the project activities is above the 100-year floodplain.

The area is a nesting and wintering range of the bald eagle, and nesting eagles are within 15 miles of the plant. Washington County is also a breeding range for another protected species, the peregrine falcon. Several species of river mussels and plants are on either federal or state endangered or threatened lists. Sensitive wetlands are in the general area surrounding the plant but will not be affected by the project. Plant King is within the boundaries of the National St. Croix Riverway, where land development is restricted by state and local regulations. Further industrial use is not permitted, and Plant King, which was built before these regulations came into effect, has donated several hundred acres to the State of Minnesota.

Population growth in Washington County (1986 population: 128,300) is outstripping that of both the U.S. and Minnesota. The unemployment rate is much lower than either the U.S. or state averages.

Since this site along the St. Croix River was an area important to early settlement in this region, many archaeological and historical sites are located north and south of Plant King, but not in the immediate area where project operations will occur.

3.5 Homer City Power Station, Pennsylvania

This generating plant and coal cleaning facility are located in Homer City, Indiana County, on Two-Lick Creek, a tributary of the Conemaugh River, approximately 30 miles east of Pittsburgh. The immediate surrounding area is undeveloped (i.e., wooded) or devoted to agriculture. The nearest urban land uses are in the communities of Homer City, two miles north of the plant on State Highway 119, and Graceton, approximately one mile east of the plant. The Allegheny Plateau has a temperate climate with mild summers and moderately cold winters. Prevailing winds are from the west-southwest.

Although Indiana County is officially in attainment for ozone, adjacent counties are not; Indiana county may therefore be redesignated a nonattainment area for ozone; the county is in attainment for NO_2, SO_2, CO, PM-10, and other NAAQS.

Unit 3 of the plant is the newest unit. Although the plant has had some problems complying with opacity and SO_2 standards, implementation of the continuous emission monitoring program has improved plant compliance.

Homer City Power Plant draws water from Two Lick Creek, a tributary of the Conemaugh River. This water is classified as suitable for warm water fishing, recreation, and drinking water. It is the water supply for Homer City and Indiana County. In 1988, the plant had some problems complying with its NPDES permit limitations. After conducting bioassay assessments, the plant corrected the violations. The plant is located above the 100-year floodplain. Groundwater quality in this heavily mined area is poor and tends to be high in iron, chloride, and manganese.

Most of the region is mixed eastern hardwood and second-growth woods. Species within a ten-mile radius of the plant that are listed by the State of Pennsylvania as threatened include the least bittern and the eastern wood rat. Scrub wetlands lie directly south of the plant, and open water ponds are within a half mile of the plant and to the east of the railroad. The proposed project, however, will not affect these wetland areas.

Indiana County (1986 population: 92,400) has experienced only a very small increase in population in recent years, lower than the state as a whole. The unemployment rate is nearly twice U.S. and state averages.

Several prehistoric Indian sites are in the vicinity of the plant, but they will not be affected by the proposed project.

3.6 Cheswick Power Station, Pennsylvania

The Cheswick Power Station is located in Springdale, Allegheny County, Pennsylvania on the Allegheny River, approximately 15 miles northeast of Pittsburgh. The Cheswick Power Station is bordered on the north, south, and west by an older residential area and agricultural areas and is located within a half mile of a downtown area. The Allegheny River flows to the south of the plant. Prevailing winds are from the west-southwest.

Allegheny County is a nonattainment area for SO_2 and O_3; parts of the county are not in attainment for PM-10 and CO; the county is in attainment for NO_2. Although the Cheswick Plant has had some problems with particulate emissions, corrective action was taken and the plant is in compliance with state and federal air quality standards.

The Cheswick Power Station draws water from and discharges into the Allegheny River, which is classified for drinking water and recreational use. The plant has had no major problems complying with its NPDES permit. Groundwater quality in the area is typical of that in heavily mined areas; i.e., it is high in iron chloride, and manganese. The plant site is in the 100-year floodplain.

Two species listed as threatened are found within a ten-mile radius of the plant: the Kirtland snake and the bullhead minnow. In addition, the State of Pennsylvania has listed the water shrew and the wood rat as species of special concern.

The Cheswick Power Station is in a forested wetland corridor. Riddle Run flows into the Allegheny River at the power plant; however, these wetlands will not be affected by the proposed project.

Allegheny County (1986 population: 1,373, 600) has lost population in recent years, and the unemployment rate is higher than national and state averages.

Several prehistoric Indian sites, both village and camp sites, are located outside the plant boundaries.

3.7 Sites of Other Project Activities

In addition to the six electric utility sites where field testing will occur, there will be laboratory scale and pilot plant scale testing at four additional locations. These include the University of North Dakota's Energy and Mineral Research Center on the campus of UND in Grand Forks, North Dakota; CQ Inc.'s Coal Quality Development Center (CQDC) near Homer City, Pennsylvania; C-E's Kreisinger's Development Laboratory (KDL) near Windsor, Connecticut; and B&W's Alliance Research Center near Alliance, Ohio. Following is a brief description of these sites and planned activities.

The UNDEMRC is a former DOE-operated facility which employs 216 persons and occupies 120,000 square feet of laboratory and office space on the UND campus. A few pounds each of 23 coal samples will be combusted in the UNDEMRC's drop tube furnace during the course of this project.

Owned by CQ Inc., the CQDC is on a four-acre tract of land in a rural setting near the Homer City Power Station (previously described in Section 3.5). Coal to be consumed in the pilot plant testing will first be shipped to CQDC where coal cleanability testing will be conducted on samples following which the samples (totaling about 500 tons) will be sent to the other pilot plants.

The Kreisinger Development Laboratory is on a six-acre complex that includes much of C-E's engineering research and development capabilities. The KDL is located on the outskirts of Windsor, a city of 40,000 population, located about 20 miles north of Hartford. About 340 tons of coal will be consumed in C-E's Fireside Performance Test Facility over the course of 17 tests during a two year span.

B&W's Alliance Research Center is in a campus type setting on 37 acres of land about 25 miles east of Canton, Ohio. About 135 tons of coal will be burned in B&W's 6 MBTU per hour small boiler simulator during 1991 as a result of this project. As with the other facilities described above, the testing uses an existing device that is routinely used for these purposes.

4.0 COMPLIANCE MONITORING

This section addresses the compliance monitoring plan of each facility. There are two types of monitoring: compliance monitoring and supplemental monitoring. Compliance monitoring is the monitoring required by local, state, and federal environmental authorities to demonstrate compliance with applicable regulations and permits. Compliance monitoring of gaseous, aqueous, and solids streams as required by each plant's environmental operating permits is presented. Also discussed in this section are any workplace ambient and personnel monitoring activities.

4.1 Permit Monitoring

Permit monitoring is defined in this document as being the monitoring of parameters that is required by the plant's environmental operating permits[1]. The monitoring of these parameters is divided into the following sections: gaseous streams, aqueous streams, and solid waste and by-product streams. Each facility is individually addressed within each section.

4.1.1 Gaseous Streams

This section discusses the monitoring of gaseous streams that is required by air emissions permits. The monitoring plan given for each site is part of normal operations and will not be modified for test burn, i.e., baseline and improved quality.

The monitoring required at each plant by the respective air emissions permits is presented in Table 4-1. Each host utility is required to monitor SO_2 emissions and opacity. Other parameters commonly monitored

[1] In the case of a "grandfather" source which has no permit, monitoring to demonstrate compliance with applicable regulations will be presented.

TABLE 4-1. GASEOUS COMPLIANCE MONITORING SCHEDULE: PLANTS WATSON, GASTON, NORTHEASTERN, KING, HOMER CITY, AND CHESWICK

	SO_2	Opacity	Particulate Matter	NO_x	O_2
Watson	1/S	C	1/S	---	---
Gaston	1/W	C	---	---	---
Northeastern	C	C	---	C	---
King	C	C	---	---	C
Homer City	C	C	---	---	C
Cheswick	C	C	---	---	---

1/S = Once per coal shipment (analysis of coal quality parameters);
1/W = Once per week (analysis of sulfur content of coal); and
C = Continuous (monitoring of flue gas).

include particulate matter, nitrous oxide, and O_2 diluent. Fugitive emissions are not required to be monitored at any of the sites. However, each facility practices procedures which limit fugitive emissions from roadways, coal unloading systems, coal stockpiles, ash haul trucks, etc. Since there will be no construction or additional coal handling associated with this project, these systems are expected to be unaffected.

Plant Watson

Plant Watson has a total of six air emission points permitted by the Mississippi Department of Natural Resources (Permit No. 1020-00055). Five of these points are associated with the five boiler units. The final point is associated with a combustion turbine. The permitted point of interest is defined as emission point 004 and is associated with the test boiler unit, Unit 4. The following pollutants emanating from this emission point are monitored: opacity, sulfur dioxide, and particulate matter. In-stack instrumentation is used to continuously monitor the plume's opacity. Sulfur dioxide and particulate matter emissions are predicted through coal quality analyses. Each shipment of coal is sampled to determine the percent sulfur, percent ash, and heating value. Coal quality data and approximate tonnage of fuel fired is reported quarterly. No ambient air monitoring is required at Plant Watson.

Plant Gaston

Plant Gaston has two air emission points permitted by the Alabama Air Pollution Control Commission (Permit No. 4-11-0005-Z005). The first point is the stack which emits gases from Units 1-4, while the second point is the stack associated with Unit 5, the test unit. Plant Gaston's permit requires opacity and sulfur dioxide emissions to be monitored. Opacity is monitored continuously by a transmissometer at a point downwind of the pollution control equipment. Sulfur dioxide emissions are predicted by analyzing coal quality on a weekly basis. In addition, the permit requires ambient air monitoring for sulfur dioxide be conducted. The type, number, and location of these instruments is subject to approval by the director of the Alabama Air Pollution Control Commission. Pursuant to this requirement, Plant Gaston currently conducts ambient air monitoring for sulfur dioxide at three offsite locations.

Plant Northeastern

Air emissions for Plant Northeastern are permitted by the Air Quality Service, Environmental Health Services, Oklahoma State Department of Health (Permit No. 75-010-0). This permit allows the operation of two coal-fired steam turbine generating units. These units are associated with the two coal fired boilers. Monitoring of opacity, sulfur dioxide, and nitrous oxide emissions is required. All three pollutants are monitored continuously using in-stack instrumentation. There are no ambient air monitoring requirements at Plant Northeastern.

Plant King

Plant King's air emissions are permitted by the Minnesota Pollution Control Agency (Permit No. 202G-86-OT-1). The primary emission point is associated with its single coal-fired boiler unit. This stack has a height of 785 feet and is fitted with two electrostatic precipitators. A smaller second stack releases emissions from the auxillary boiler unit and has a height of 205 feet. This auxillary boiler is authorized to burn distillate fuel oil and natural gas only and is not directly affected by the proposed test burns. Plant King conducts continuous in-stack monitoring of opacity, sulfur dioxide, and diluent (O_2) emissions in the primary 785-foot stack. In addition, coal quality is analyzed on a daily basis to further demonstrate compliance with sulfur dioxide emission limitations. There are no ambient air monitoring requirements at Plant King.

Homer City

Air emissions for Plant Homer City are regulated by the Pennsylvania Department of Environmental Resources. Homer City's air emissions are "grandfathered" and therefore do not have a permit. Homer City however performs monitoring to demonstrate compliance with Title 25 of the Pennsylvania Code, Chapter 139, Subchapter C, titled "Requirements for Continuous In-Stack Monitoring for Stationary Sources." For the emissions from the test unit, Homer City conducts continuous in-stack monitoring of opacity, sulfur dioxide, and diluent (O_2) emissions. No ambient air monitoring is required at Plant Homer City.

Cheswick

Cheswick's primary air emission point is associated with its single coal-fired boiler unit. This point is permitted by the Allegheny County Health Department (Permit No. 14847). This stack has a height of 750 feet and is fitted with one electrostatic precipitator manufactured by Research-Cottrell, Inc. Opacity and SO_2 emissions from this stack are continuously monitored using in-stack instrumentation. Results of this monitoring is reported quarterly to the Allegheny County Health Department, Bureau of Air Pollution Control. No ambient air monitoring is required at Plant Cheswick.

Alliance Research Center.

The Alliance Research Center is a campus/laboratory occupying 37 acres of land outside Alliance, Ohio (about 25 miles east of Canton, Ohio). The small boiler simulator (SBS) is normally in operation 8 hours/day, 2 days/week, 20 weeks/year. The current air emissions permit (Permit No. 1576010601) is pending approval from the Ohio EPA. Flue gas from the SBS is continuously monitored for CO, CO_2, O_2, NO_x, and opacity. No ambient air monitoring is required at this facility.

Kreisinger Development Laboratory (KDL).

KDL is located on the outskirts of Windsor, Connecticut. Pilot scale testing will be conducted in C-E's Fireside Performance Test Facility (FPTF). Air emissions from this facility are permitted by the Connecticut Department of Environmental Protection (Permit No. P212-0062). The permitted point source for gaseous emissions has an electrostatic precipitator which reduces particulate emissions by up to 98 percent. As part of compliance with the air emissions permit for this facility, continuous in-stack monitoring of SO_2 and NO_x is conducted. In addition, annual reports detailing the type, quality, and amount of fuel burned as well as the number of operating hours for the year are submitted to the Connecticut Department of Environmental Protection as part of the air emissions permit. No ambient air monitoring is required at this facility.

4.1.2 Aqueous Streams

This section discusses the compliance monitoring plan for aqueous streams during the testing periods. This section primarily addresses the outfalls that are associated with industrial processes, i.e., storm drainage and sanitary wastewater outfalls are largely unaddressed. None of the outfalls (industrial, storm drainage, and sanitary) are expected to experience any change in wastewater characteristics or volumetric discharge rates as a result of the proposed test burns. No construction at any of the sites is necessary; therefore, monitoring of ambient water quality or aqueous streams due to construction-related activities is unnecessary.

Plant Watson

Plant Watson's NPDES permit (Permit No. MS0002925) specifies six outfalls related to industrial operations: one is an intake canal (outfall 001), two discharge into the ash pond (outfalls 004 and 012), and the other three discharge directly into the surrounding environment (outfalls 002, 003, 005). The primary outfall of concern is 002. This discharge accounts for approximately 96 percent of all the aqueous wastewater discharged to the environment. The compliance monitoring schedule for the industrial discharges is presented in Table 4-2. Plant Watson is not required to monitor groundwater.

Plant Gaston

The NPDES permit for Plant Gaston (Permit No. AL0003140) specifies four outfalls which discharge to a natural receiving water: 001, 002, 004, and 025. Two of these four outfalls (outfalls 001 and 002) discharge over 90

TABLE 4-2. COMPLIANCE MONITORING SCHEDULE: PLANT WATSON AQUEOUS DISCHARGE STREAMS

Outfall	Parameter	Monitoring Frequency
001	Flow	Continuous
	Temperature	Continuous
	pH	Weekly
002	Flow	Continuous
	Free Available Chlorine	Weekly
	pH	Weekly
003	Flow	Continuous
	Oil and Grease	Weekly
	Total Suspended Solids	Weekly
	pH	Weekly
	Heavy Metals[1]	Quarterly
004	Flow	Weekly
	Free Available Chlorine	Weekly
	pH	Weekly
	Zinc[2]	Monthly
	Chromium[2]	Monthly
	Phosphorus[2]	Monthly
005	Flow	Continuous
	Oil and Grease	Weekly
	Total Suspended Solids	Weekly
	pH	Weekly
012	Flow	Continuous
	Total Copper	Daily
	Total Iron	Daily
	Oil and Grease	Daily
	Total Suspended Solids	Daily
	pH	Weekly

1 Heavy Metal analysis shall include total copper, iron, nickel, zinc and frequency of analysis is subject to semi-annual review and possible reduction or elimination.

2 These parameters shall be monitored and limited only in those instances where materials containing these pollutants are added to the cooling water and/or boiler water and are subject to being discharged.

percent of the total wastewater. The compliance monitoring schedule for the four outfalls which discharge to the environment and the 16 other internal outfalls permitted by the NPDES permit is presented in Table 4-3. Plant Gaston is not required to monitor groundwater.

Plant Northeastern

The NPDES permit for Plant Northeastern (Permit No. OK0034380) specifies four outfalls. Outfalls 001 and 004 discharge into the Verdigris River while 002 and 003 empty into Fourmile Creek. Fourmile Creek flows directly into the Verdigris River. Each outfall represents the following percentage of the total discharge flow: 001 (19 percent), 002 (20 percent), 003 (60 percent), 004 (1 percent). The compliance monitoring schedule for these outfalls is presented in Table 4-4.

Plant Northeastern currently monitors groundwater to detect any possible effects from the total retention basin. This monitoring is required by the Industrial and Solid Waste Service, Environmental Health Services, Oklahoma State Department of Health, Permit No. 3566012. Groundwater samples are analyzed for the following parameters at least once a year: pH, total organic carbon, iron, total alkalinity, total dissolved solids (TDS), total nitrogen, ammonium, fluorides, sodium, and chemical oxygen demand.

Plant King

The NPDES permit for Plant King (Permit No. MN0000825) specifies five outfalls that collectively discharge into Lake St. Croix. The outfall that discharges the condenser cooling water (outfall 20100) accounts for over 98 percent of the aqueous wastewater. The compliance monitoring schedule for the primary outfall and other lesser streams that discharge to natural receiving waters is presented in Table 4-5.

Plant King currently monitors 13 wells that were installed to identify any possible effects from the offsite ash landfill. The ash landfill permit (MPCA Permit No. SW-54) requires the following parameters be monitored in April, July, and October of each year: arsenic, boron, pH, selenium, specific conductance, sulfate, temperature, and total dissolved solids. A more extensive list of parameters is monitored in July of every odd numbered year (starting in 1987): alkalinity, arsenic, barium, boron, cadmium, calcium, chloride, chromium, iron, lead, magnesium, manganese, nitrate, pH, potassium,

TABLE 4-3. COMPLIANCE MONITORING SCHEDULE: PLANT GASTON AQUEOUS DISCHARGE STREAMS

Outfall	Parameter	Monitoring Frequency
001, 002	Flow	Daily
	Intake Temperature	Daily
	Discharge Temperature	Daily
	Total Residual Chlorine	Daily
	Time of Chlorine Discharge	Daily
003	Flow	Weekly
	Free Available Chlorine	Weekly
	Total Chromium	Annual
	Zinc	Annual
004	Flow	1/Month
	pH	Daily
	Oil and Grease	1/Month
	Total Suspended Solids	1/Month
005-008	Flow	Quarterly
	pH	Quarterly
	Fecal Coliform	Quarterly
	Biochemical Oxygen Demand	Quarterly
	Total Suspended Solids	Quarterly
009	Flow	Daily
	pH	Daily
	Oil and Grease	Daily
	Total Suspended Solids	Daily
	Copper	Daily
	Iron	Daily
010-015	Flow	Monthly
	pH	Monthly
	Iron	Monthly
	Manganese	Monthly
	Total Suspended Solids	Monthly
	Oil and Grease	Monthly
022-024	Flow	Monthly
	Temperature	Monthly
	Oil and Grease	Monthly
025[1]	Flow	N/A
	pH	N/A
026	Flow	Weekly
	pH	Weekly
	Iron	Weekly
	Manganese	Weekly
	Total Suspended Solids	Weekly

[1] This discharge is permitted with no monitoring requirements or limitations, provided the permitteee adds no pollutants to the discharge (i.e., waste streams within the plant which contribute to this discharge are monitored).

TABLE 4-4. COMPLIANCE MONITORING SCHEDULE: PLANT NORTHEASTERN AQUEOUS DISCHARGE STREAMS

Outfall	Parameter	Monitoring Frequency
All**	Flow	Continuous
001	Temperature	Continuous
	Free Available Chlorine	1/Week
002	Oil & Grease	1/Week
	Total Suspended Solids	1/Week
003	Temperature	Continuous
	Free Available Chlorine	1/Week
004	Flow	1/Week
	Total Suspended Solids	1/Week

** Except Outfall 004

TABLE 4-5. COMPLIANCE MONITORING SCHEDULE: PLANT KING AQUEOUS DISCHARGE STREAMS

Outfall	Parameter	Frequency
20100	Flow	Continuous
	Temperature	Continuous
20101	Flow	Daily[1]
	Oil and Grease	Daily[1]
	Total Iron	Daily[1]
20102	Flow	Weekly
	Total Suspended Solids	Weekly
	Turbidity	Weekly
	Oil and Grease	Weekly
	pH	Continuous
20103	Flow	Continuous
20104	Flow	2/Month

[1] Sampling only required during discharge events.

selenium, sodium, specific conductance, sulfate, temperature, total dissolved solids, total suspended solids, and zinc.

Homer City

The NPDES permit for the Homer City plant (Permit No. PA0005037) specifies 20 outfalls. Thirteen of these outfalls are drainage basin discharges and are only in operation during storm events. The compliance monitoring schedule for the routinely operational outfalls that discharge to natural receiving waters is presented in Table 4-6.

Homer City currently conducts an extensive groundwater monitoring program. The Department of Environmental Resources Industrial Waste Water Quality Management Permit No. 3281205 requires groundwater monitoring of 13 wells associated with the ash disposal site and plant impoundments. Samples collected quarterly are analyzed for the following parameters: pH, temperature, alkalinity, conductivity, total dissolved solids, chlorides, sulfates, dissolved iron, and dissolved manganese. In addition, annual samples are analyzed for the following dissolved parameters: aluminum, arsenic, barium, cadmium, calcium, chromium, copper, lead, mercury, selenium, silver, sodium, zinc, and organic carbon.

Cheswick

Plant Cheswick's NPDES permit (Permit No. PA0001627) authorizes the discharge of wastewater to Tawney Run, Little Deer Creek, and the Allegheny River. Monitoring requirements for ten of the eleven outfalls permitted is given in Table 4-7. The last outfall (Outfall 004) receives waste from the intake screen backwash. The only monitoring requirement stipulated for this outfall is to not return the debris collected on the intake trash racks to the waterway.

Plant Cheswick currently monitors groundwater quality at two monitoring points as part of the solid waste disposal permit issued by the Department of Environmental Resources, Bureau of Solid Waste Management (Permit No. 300476). The following water quality parameters are obtained and reported on an quarterly basis: alkalinity, iron, chlorides, manganese, total dissolved solids, lead, pH, specific conductance, sulfates, copper, and zinc. In addition, the following water quality parameters are obtained and reported

TABLE 4-6. COMPLIANCE MONITORING SCHEDULE: PLANT HOMER CITY AQUEOUS DISCHARGE STREAMS

Outfall(s)	Parameter	Monitoring Frequency
001	Flow	1/Week
	Cadmium	2/Month
	pH	1/Week
003	Flow	Continuous
	Suspended Solids	1/Week
	Oil and Grease	1/Week
	Cadmium	2/Month
	pH	Continuous
004	Flow	Continuous
	Suspended Solids	1/Week
	Oil and Grease	1/Week
	Iron	2/Month
	Manganese	2/Month
	Cadmium	2/Month
	Aluminum	2/Month
	pH	1/Week
005	Flow	Continuous
	Suspended Solids	1/Week
	Oil and Grease	1/Week
	Cadmium	2/Month
	pH	1/Week
007	Flow	1/Week
	CBOD-5 day	2/Month
	Suspended Solids	2/Month
	Dissolved Oxygen	2/Month
	Fecal Coliform Organisms	2/Month
	pH	1/Week
008	Flow	1/Week
	CBOD-5 day	2/Month
	Suspended Solids	2/Month
	Dissolved Oxygen	2/Month
	Fecal Coliform Organisms	2/Month
	pH	1/Week
009	Flow	Continuous
	Suspended Solids	1/Week
	Oil and Grease	1/Week
	pH	1/Week

TABLE 4-7. *COMPLIANCE MONITORING SCHEDULE: PLANT CHESWICK AQUEOUS* DISCHARGE STREAMS

Outfall(s)	Parameter	Monitoring Frequency
001, 307	Flow	2/Month
	Suspended Solids	2/Month
	Oil and Grease	2/Month
	pH	2/Month
002	Flow	2/Month
	Suspended Solids	2/Month
	Iron	2/Month
	pH	2/Month
003	Flow	2/Month
	Total Residual Chlorine	2/Month
	Temperature	Continuous
005, 006, 207	Flow	2/Month
	Suspended Solids	2/Month
	Oil and Grease	2/Month
	pH	2/Month
103, 107 407	Flow	2/Month
	Suspended Solids	2/Month
	pH	2/Month

on an annual basis: arsenic, barium, cadmium, chromium (total), silver, aluminum, calcium, sodium, and total organic carbon.

Alliance Research Center

The Alliance Research Center has one outfall specified in their NPDES permit (Permit No. 3ID00038001). The compliance monitoring schedule for this outfall is presented in Table 4-8.

Kreisinger Development Laboratory (KDL)

The NPDES permit for KDL (Permit No. CT0000353) requires the monitoring of the industrial drain system at KDL. The compliance monitoring schedule for these drains is presented in Table 4-9.

4.1.3 Solid Waste and By-Product Streams

This section discusses the compliance monitoring plan for solid waste and by-product streams at each facility. In general, very little, if any, compliance monitoring of solid streams is required at a given facility. No construction at any of the facilities is necessary; therefore, monitoring of solid streams associated with construction-related activities is unnecessary.

Plant Watson

No compliance monitoring of solid waste or by-product streams is required at Plant Watson.

Plant Gaston

No compliance monitoring of solid waste or by-product streams is required at Plant Gaston.

Plant Northeastern

No compliance monitoring of solid waste or by-product streams is required at Plant Northeastern.

TABLE 4-8. COMPLIANCE MONITORING SCHEDULE: ALLIANCE RESEARCH CENTER AQUEOUS DISCHARGE STREAMS

Parameter	Monitoring Frequency
Flow	1/Month
pH	1/Month

TABLE 4-9. COMPLIANCE MONITORING SCHEDULE: KREISINGER DEVELOPMENT LABORATORY AQUEOUS DISCHARGE STREAMS

Parameter	Monitoring Frequency
Flow	Continuous
pH	1/Week
Conductivity	1/Week
Suspended Solids	1/Week
Temperature	1/Week
Color	1/Week

Plant King

The permit for the A.S. King Coal Ash Landfill (MPCA Permit No. SW-54) requires a daily record of the volume of the ash sent to the ash landfill be maintained. No other compliance monitoring of solid waste or by-product streams is required at Plant King.

Homer City

No compliance monitoring of solid waste or by-product streams is required at the Homer City refuse disposal facility.

Cheswick

Plant Cheswick uses the Kissick bottom ash disposal area for the disposal of a portion of its solid waste, specifically bottom and fly ash. According to the permit for this facility (Commonwealth of Pennsylvania Department of Environmental Resources Bureau of Solid Waste Management Permit No. 300476), every two years, statistical information of the waste volumes received during the previous years and an estimate of the remaining site capacity is required. No other compliance monitoring of solid wastes or by-product streams is required.

Alliance Research Center

The primary solid waste is the ash from the small boiler simulator. This ash is disposed of in the Kimble landfill which is not operated by the Alliance Research Center. No compliance monitoring of solid wastes or by-product streams is required by permit for disposal in this facility.

Kreisinger Development Laboratory (KDL)

KDL disposes of its solid waste at the Windsor Sanitary Landfill which is operated by the City of Windsor, Connecticut. No compliance monitoring of solid wastes or by-product streams is required by permit for disposal in this facility.

4.2 Health and Safety Monitoring

There are two types of health and safety monitoring that may be routinely conducted at a power plant. These are industrial hygiene monitoring and medical surveillance. Industrial hugiene monitoring includes the use of personal dosimeters to determine when unsafe exposures to certain compounds has occurred and it includes the use of workplace ambient monitoring equipment. Medical surveillance, on the other hand, is the monitoring of medical records--based on physical examination and lab tests--of employees who may be at risk for various occupational illnesses.

Health and safety officials at the six power plants associated with this project were contacted to determine the extent to which either of these types of monitoring were being conducted. The results of these contacts are provided in Table 4-10.

TABLE 4-10. HEALTH AND SAFETY MONITORING CONDUCTED AT SIX ELECTRIC UTILITIES

Power Plant	Industrial Hygiene	Medical Surveillance
Watson, Mississippi Power Company	--noise dosimeters (as needed) --air sampling for carbon dioxide and sulfur dioxide (as needed)	Annual physical exam for appropriate personnel consisting of chest X-ray, lung function, blood pressure, height, weight, and audiogram
Gaston, Alabama Power Company	--dosimeter badges for personal monitoring of arsenic, asbestos, heat stress, noise, and sulfur dioxide (as needed)	None
Northeastern, Public Service of Oklahoma	--personal monitoring conducted on an as needed basis only	Physical exams given on an as needed basis only
King, Northern States Power Company	--dosimeter badges for personal monitoring of asbestos and organic vapors (as needed)	Annual physical examinations are given to employees who wear dosimeter badges

TABLE 4-10. (Continued)

Power Plant	Industrial Hygiene	Medical Surveillance
Homer City Penelec/NYSEG	--Dosimeter badges for personal monitoring of noise, heat, arsenic, asbestos, coal dust, mercury, silica dust, welding fumes, and different solvents (as needed) --Area sampling performed as needed	Annual physical exam consisting of audiogram, skin and nasal exam, blood pressure, pulmonary function test, and optional chest X-ray for appropriate personnel
Cheswick, Duquesne Light Company	--dosimeter badges for personal monitoring of noise, arsenic, and asbestos (as needed) --area sampling conducted on an as needed basis only	Optional annual audiometric testing and asbestos physical

5.0 SUPPLEMENTAL MONITORING

Supplemental monitoring is defined in this document as being that monitoring that is not required in any of the environmental operating permits. This section addresses the supplemental monitoring programs that are currently being performed, or will be performed as part of the demonstration phase of this project (i.e., test measurements required to develop the database for the expert system and associated documentation). The following areas are addressed: test monitoring, health and safety monitoring, and other existing monitoring programs.

5.1 Test Monitoring

Test monitoring is that monitoring that will be performed as a part of the demonstration phase of the project (i.e., test measurements required to develop the database for the expert system and associated documentation). This monitoring plan will be implemented at the six electric utilities for both the baseline and improved quality test burns. Since the fundamental testing procedure will vary little, if any, among the six utilities, an individual discussion of each utility would be redundant and is therfore not presented. This section is divided into two categories: (1) source monitoring and (2) process and operating conditions monitoring.

5.1.1 Source Monitoring

Source monitoring is defined in this document as being the monitoring of parameters that contribute to the waste streams that are released into the environment. The monitoring of these parameters is divided into the following sections: gaseous streams, aqueous streams, and solid waste and by-product streams.

Gaseous Streams

Table 5-1 summarizes the gaseous parameters to be monitored, sampling location, and monitoring frequency. The focus of the source monitoring of gaseous streams is on the flue gas resulting from the firing of the test coals. This flue gas will be monitored at a variety of locations: boiler exit, ESP inlet, ESP outlet, and stack exit. Flue gas at the boiler exit will be continuously monitored for O_2, CO_2, CO, NO, and SO_2. The ESP inlet will be monitored for SO_3, NO_x, particulate matter (PM), and particle size distribution. The ESP outlet will be monitored for particulate matter. Finally, the opacity of the plume emanating from the stack will also be monitored.

Two type of monitoring frequencies are designated for this monitoring plan: once per test condition and continous. Once per test condition should be interpreted as a single monitoring event occuring over a discreet time interval during a given test condition. (During the two test burns, as many as 20 distinct and separate test conditions will be evaluated. Parameters which determine a test condition include coal loading and excess air requirements.) Continuous monitoring, on the other hand, is intended to indicate the variability of a given parameter with time. This variability can be determined using strip charts or multiple discreet readings, e.g., recording a value every 15 minutes. Continuous monitoring will be conducted when plant conditions are in accordance with the desired test conditions. That is, continuous monitoring will occur only during actual testing events and should not be interpreted as being conducted 24 hours per day.

Aqueous Streams

Wastewater is treated before being discharged into the environment. Since no changes in the hydraulic loading to the treatment systems are expected, there should be no significant changes in the volumetric intake or

TABLE 5-1. GASEOUS TEST MONITORING SCHEDULE: PLANTS WATSON, GASTON, NORTHEASTERN, KING, HOMER CITY, AND CHESWICK

Parameter	Monitoring Location [a]			
	Boiler Exit	ESP Inlet	ESP Outlet	Stack
Opacity	--	--	--	1/T [c]
SO_2	C	--	--	--
SO_3	--	$1/T_{ESP}$	--	--
NO	C	--	--	--
NO_x	--	$1/T_{ESP}$	--	--
CO	C	--	--	--
CO_2	C	--	--	--
O_2	C	--	--	--
[b]Particulate Matter	--	$1/T_{ESP}$	$1/T_{ESP}$	--
[b]Particle Size Distribution	--	$1/T_{ESP}$	--	--
[b]Fly Ash Resistivity	--	$1/T_{ESP}$	--	--

[a] *Monitoring Frequency:*

C = Continuous;
1/T = Once per test condition; and
$1/T_{ESP}$ = Once per standard ESP test.

[b] Passage through ESP alters parameter value.

[c] Compliance monitoring is performed more frequently at each plant, i.e., continuous.

discharge of water nor in the quality of the wastewater discharges. Accordingly, additional monitoring of the aqueous discharge streams as a result of the proposed test burns is not recommended.

Solid Streams

Test monitoring of solid streams for these sites is summarized in Table 5-2. This monitoring plan focuses on the incoming feed coal and the residual ash after firing.

The mass and characteristics of the feed coal (i.e., test burn coals) will be closely monitored. Mass flow will be monitored hourly. Samples of this coal will be collected at least twice per day and subjected to the following analyses: proximate analysis, ultimate analysis, calorific value, mineral ash, ash fusion, and grindability.

Proximate analysis determines the moisture content, volatile matter (gases released when coal is heated), fixed carbon (solid fuel left after the volatile material is driven off), and ash (impurities commonly consisting of silica, iron, alumina, and other incombustible matter). Ultimate analysis determines the amount of carbon, hydrogen, oxygen, nitrogen, and sulfur. Calorific value is a measure of the energy content of the coal and is measured in terms of Btu/lb. The mineral ash analysis details the individual minerals found in the ash. Ash fusion temperature is the temperature at which the ash forms clinker or slag. Grindability is a measure of the ease with which coal can be pulverized.

5.1.2 Process and Operating Conditions Monitoring

Process and operating conditions monitoring is defined as that monitoring needed to characterize the plant operating conditions. Since the purpose of these test burns is to provide data on the relationship between plant performance and the quality of the coal burned, an extensive monitoring program of the plant's operating conditions will be implemented.

TABLE 5-2. SOLIDS TEST MONITORING PLAN: PLANTS WATSON, GASTON, NORTHEASTERN, KING, HOMER CITY, AND CHESWICK

Parameter	Location	Sampling Frequency[a,b]
Feed Coal Proximate Analysis Ultimate Analysis Calorific Value Mineral Ash Ash Fusion Grindability	Feeder Inlet	2/day
Coal Flow (mass)	Coal Flow Integrators	1/hr
Bottom Ash Carbon Content Sulfur Content	Bottom Ash Hopper	1/T
Fly Ash Carbon Content Sulfur Content	Fly Ash Hopper	1/T

[a] Monitoring Frequency:

2/day = Twice per day;
1/hr = Once per hour; and
1/T = Once per test condition.

[b] Analysis frequency may be different due to compositing of samples.

Table 5-3 summarizes the categories and types of test monitoring to be performed. These tests will be conducted according to the "Coal Quality Field Test Plan" that will be developed for each site by the following parties: Fossil Energy Research Corporation (Laguna Hills, CA); Electric Power Technologies, Inc. (Berkely, CA); Energy and Environmental Reserach (Orrville, OH); Southern Company Services (Birmingham, AL); and Southern Research Institute (Birmingham, AL). These field test plans will be developed based on the Guidelines for Fireside Testing in Coal-Fired Power Plants published by the Electric Power Research Institute.

5.2 Health and Safety Monitoring

As discussed in Section 4.2, there is nothing in the project that would pose new health and safety risks or increase current health and safety risks or exposure. Therefore no supplemental health and safety monitoring is recommended.

5.3 Other Existing Monitoring Programs

This section presents monitoring that is currently being performed at the various sites that is not required by any of the environmental operating permits. These monitoring programs have been divided into the following categories: ambient air monitoring, groundwater monitoring, and solid waste monitoring.

5.3.1 Ambient Air Monitoring

This section addresses any ambient air quality monitoring programs that have been implemented at the respective sites that are not specifically required under any of the environmental operating permits.

Plant Watson

Plant Watson does not conduct supplemental monitoring of ambient air quality.

Plant Gaston

Plant Gaston does not conduct supplemental monitoring of ambient air quality.

TABLE 5-3. TEST MONITORING OF PROCESS AND OPERATING CONDITIONS

Category	Type[1]
Feed Coal	Raw Coal Sample Coal Flow and Handling
Mills	Pulverizer Power Mill Vibration Mill Rejects PC Sample Dirty Pitot
Boiler	Feedwater Superheat/Reheat Attemperation Steam Temperature Control Boiler Metal Temperature Air Heater Temperature Flue Gas Analysis Mill Differential Precipitator Hopper Pluggage
Gas Flows	Primary Air Combustion Air
Performance	Bottom Ash Fouling Fly Ash Flame Stability Furnace Draft and Air Heater Differential Pressures
Precipitator	Power - V/I Curves Flue Gas Flow Inlet Dust Loading/Size Fly Ash Resistivity Collection Efficiency Rapper Control System Stratification at Inlet

[1] A description of each test designated is discussed in the Guidelines for Fireside Testing in Coal-Fired Power Plants published by the Electric Power Research Institute.

Plant Northeastern

Plant Northeastern does not conduct supplemental monitoring of ambient air quality.

Plant King

Plant King currently monitors ambient air quality for particulate matter at two sites. This additional monitoring is conducted as part of an internal evaluation of fugitive dust emissions and is not required by any permitting agency.

Plant Homer City

Plant Homer City does not conduct supplemental monitoring of ambient air quality.

Plant Cheswick

Environmental Systems Corporation (ESC) operates a continuous ambient air quality monitoring program for Duquesne Light Company covering the Cheswick power plant. This program consists of 7 monitoring points. The parameters monitored and the corresponding number of points that monitor the parameter are as follows: sulfur dioxide (7), nitrous oxides (1), total suspended particulates (3), inhalable particulates (3), particulates having an aerodynamic diameter of 10 microns or less, i.e., PM-10 (1), and meteorological data (1). Meteorological data includes wind speed and direction, temperature, and a temperature gradient (2 meters to 17 meters). Data from the program is analyzed for exceedances of the National Ambient Air Quality Standards (NAAQS) and for the impact of the power plants on the ambient air quality. The program is operated under a strict Quality Assurance Program which was developed to meet the USEPA QA requirements for Prevention of Significant Deterioration (PSD), as well as those found in 40 CFR Part 58.

Alliance Research Center

Alliance Research Center does not conduct supplemental monitoring of ambient air quality.

Kreisinger Development Laboratory (KDL)

Kreisinger Development Laboratory does not conduct supplemental monitoring of ambient air quality.

5.3.2 Groundwater Monitoring

This section addresses any groundwater monitoring programs that have been implemented at the respective sites that are not specifically required under any of the environmental operating permits.

Plant Watson

Plant Watson does not conduct any supplemental monitoring of groundwater quality.

Plant Gaston

Plant Gaston conducts voluntary monitoring of the following parameters: arsenic, cadmium, chromium, lead, mercury, selenium, iron, magnesium, pH, conductivity, and total dissolved solids. This monitoring is only intended to provide background groundwater quality data; therefore, all monitor wells are located in an area removed from plant operations.

Plant Northeastern

Plant Northeastern does not conduct any supplemental monitoring of groundwater quality.

Plant King

Plant King currently conducts supplemental monitoring of four (4) groundwater monitor wells. This monitoring is part of a remedial action program from a spill of an estimated 1,800 gallons of #2 Fuel Oil. These monitor wells are located adjacent to the boiler, on the northeast side.

Plant Homer City

A Regenerant Waste Consent Order and Agreement (COA) executed between Penelec and the Department of Environmental Resources (DER) requires groundwater monitoring of four wells associated with RCRA flow equalization ponds. Samples collected quarterly are analyzed for the following parameters: pH, temperture, acidity, alkalinity, conductivity, chloride, sulfate, total dissolved solids, ortho-phosphate, and dissolved constituents (aluminum, arsenic, barium, beryllium, cadmium, chromium, iron, lead, manganese, mercury, selenium, silver, and sodium).

As part of a second COA between Penelec and DER, groundwater monitoring of three wells and one spring associated with the emergency strike ash disposal site is conducted. Samples are collected annually and analyzed for the following parameters: pH, temperature, conductivity, alkalinity, chloride, fluoride, ortho-phosphate, biochemical oxygen demand, chemical oxygen demand, total suspended solids, total solids, settleable solids, total iron, dissolved aluminum, and dissolved manganese.

Plant Cheswick

Plant Cheswick does not conduct any supplemental monitoring of groundwater quality.

Alliance Research Center

Alliance Research Center does not conduct supplemental monitoring of groundwater quality.

Kreisinger Development Laboratory (KDL)

Kreisinger Development Laboratory does not conduct supplemental monitoring of groundwater quality.

5.3.3 Solid Waste Monitoring

This section addresses any solid waste monitoring programs that have been implemented at the respective sites that are not specifically required under any of the environmental operating permits.

Plant Watson

Plant Watson does not conduct supplemental monitoring of solid waste.

Plant Gaston

Plant Gaston does not conduct supplemental monitoring of solid waste.

Plant Northeastern

Plant Northeastern does not conduct supplemental monitoring of solid waste.

Plant King

Plant King does not conduct supplemental monitoring of solid waste.

Plant Homer City

Plant Homer City does not conduct supplemental monitoring of solid waste.

Plant Cheswick

Plant Cheswick does not conduct supplemental monitoring of solid waste.

Alliance Research Center

Alliance Research Center performs a leachate analysis on ash samples from the small boiler simulator. This analysis is designed to detect any hazardous constituents (primarily heavy metals) that may be leached from the ash upon being placed in a landfill. If results from this test is acceptable, the shipment is disposed of in the Kimble landfill and the volume is recorded.

Kreisinger Development Laboratory (KDL)

Ash from the KDL is analyzed using the TCLP (Toxicity Characteristics Leaching Procedure) prior to disposal. This test is designed to identify any hazardous constituents that may be leached out of the ash after placement in a landfill. If results from this test is acceptable, the shipment is disposed of in the Windsor landfill and the volume is recorded.

6.0 MONITORING ACTIVITY DETAILED BY MEDIA AND PROJECT PHASE

The compliance monitoring requirements for each site is addressed in Section 4. Supplemental monitoring programs are presented in Section 5. This section combines the permit monitoring requirements and the proposed test monitoring program into an integrated monitoring schedule of the gaseous, aqueous, and solid waste sources for the six host utilities.

Projects of this nature may be divided into the following four phases: construction, pre-operational baseline, operational, and post-operational. Since no construction is associated with this project, except for the temporary installation of testing equipment, no environmental monitoring for the first phase is required (except for that monitoring required by permit for normal operations). The pre-operational baseline and operational phases correspond to the baseline and improved quality test burns. The integrated monitoring schedule presented in this section (compliance and supplemental monitoring) will be implemented for these two phases. Since there will be no permanent alterations to plant operations as a result of this project, no environmental monitoring is required (except for that monitoring required by permit for normal operations) during the final phase, i.e., post-operation.

The fundamental purpose of this section is to combine or integrate the permit and test monitoring programs into one comprehensive schedule. However, since there is no test monitoring of the aqueous discharge streams, the integrated schedule would be the same as the NPDES permit monitoring schedule. Therefore, the reader should refer to the tables presented in Section 4.0 (Compliance Monitoring) for a comprehensive review of the aqueous monitoring plan to be conducted during the two field test burns at the six host utilities:

Table	4-2:	Plant Watson	Aqueous Stream Monitoring
"	4-3:	Plant Gaston	" " "
"	4-4:	Plant Northeastern	" " "
"	4-5:	Plant King	" " "
"	4-6:	Plant Homer City	" " "
"	4-7:	Plant Cheswick	" " "

Table 6-1 presents the integrated monitoring schedule of the gaseous and solid waste source streams. In cases where both the permit and test monitoring programs specify the monitoring of a parameter at the same

TABLE 6-1. INTEGRATED MONITORING PLAN: PLANTS WATSON, GASTON, NORTHEASTERN, KING, HOMER CITY, AND CHESWICK

Parameter	Sampling Location	Frequency [a,b]
Flue Gas	Boiler Exit	Continuous
SO_2		
NO		
CO		
CO_2		
O_2		
Flue Gas	ESP Inlet	1/test
SO_3		
NO_x		
Particulate Matter		
Particle Size Distribution		
Fly Ash Resistivity		
Flue Gas	ESP Outlet	1/test
Particulate Matter		
Flue Gas	Stack	Continous
Opacity		
NO_x [c]		
SO_2 [d]		
O_2 [e]		

TABLE 6-1. (Continued)

Parameter	Sampling Location	Frequency [a,b]
Feed Coal Proximate Analysis Ultimate Analysis Calorific Value Mineral Ash Ash Fusion Grindability	Feeder Inlet	2/day
Coal Flow (mass)	Coal Flow Integrators	1/hour
Bottom Ash Carbon Content Sulfur Content	Bottom Ash Hopper	1/test
Fly Ash Carbon Content Sulfur Content	Fly Ash Hopper	1/test

[a] Section 5.0 (Supplemental Monitoring) provides a discussion on monitoring frequency terminology.

[b] Analysis frequency of solid streams may be different due to compositing of samples.

[c] Continuous in-stack monitoring of NO_x is required only at Plant Northeastern.

[d] Continuous in-stack monitoring of SO_2 is required only at Plants Northeastern, King, Homer City, and Cheswick.

[e] Continuous in-stack monitoring of O_2 is required only at Plants King and Homer City.

location, the more extensive monitoring frequency is presented. An example would be the in-stack monitoring of opacity. Each utility monitors this parameter continuously for compliance purposes; however, the test monitoring program only requires this parameter to be monitored once per test. Another example of overlap is the analysis for sulfur content in the feed coal. Plants Watson, Gaston, and King require this analysis for compliance purposes; however, the test monitoring program requires this analysis at a higher frequency as a part of the Ultimate analysis (i.e., Ultimate analysis is the standardized coal analysis which determines the percentage of carbon, hydrogen, oxygen, nitrogen, and sulfur contained in the sample).

In short, several gaseous pollutants will be monitored in various gaseous streams. Among the pollutants to be monitored include SO_2, SO_3, NO, NO_x, CO, CO_2, O_2, and PM. Nearly all of the gaseous monitoring to be performed is related to the test monitoring plan and in some cases will overlap the permit monitoring program.

The environmental monitoring of aqueous streams is limited to permit requirements. Since all aqueous streams will be unaffected by these proposed test burns, no test monitoring is recommended.

In relation to solid stream monitoring, very little permit monitoring is required. Nearly all of the monitoring to be conducted is a result of the test monitoring plan. This plan requires the sampling and analysis of the raw coal feed, bottom ash, and fly ash.

7.0 INFORMATION MANAGEMENT AND REPORTING

The database management system and the reporting activities associated with the execution of the EMP are summarized in this section.

7.1 Management Responsibilities and Requirements

A primary goal of this project is to enhance EPRI's Coal Quality Information System (CQIS) database and Coal Quality Impact Model (CQIM) to allow confident assessment of the effects of coal cleaning on specific boiler performance. For this reason, the management of data is an important and vital issue.

Electric Power Technologies (EPT), under contract with EPRI, will conduct the utility boiler field testing. Appropriately, EPT is ultimately responsible for the reduction, analysis, presentation, and interpretation of all data collected during the field test burns. However, many subcontractors will perform the actual tests and record the raw data. The test contractors involved with this project are Fossil Energy Research Corporation, Energy and Environmental Research, and Southern Research Institute.

7.2 Compliance and Supplemental Monitoring Data Flows

The data collected during these test burns will be used to enhance the existing CQIM database. This database is a result of past research and development under DOE and EPRI sponsorship and provides the foundation for the boiler performance model, CQIM. Therefore, the design and development of a new database with which to assimilate the test data is unnecessary.

The collection of data related to the compliance monitoring program will not be altered as a result of these test burns. All collecting and reporting procedures will be performed as normal, i.e., business as usual.

The test monitoring program will use data entry forms that will be designed for the proper recording of sampling and analytical data and results. These forms will be compatible with the data entry format of the CQIM. Whenever possible, data will be transmitted electronically to increase data entry efficiency and accuracy. However, the majority of the data will be recorded by hand on the specially designed data entry forms.

7.3 Data Management Procedures

All data will be reviewed for completeness and accuracy as part of the data management and processing activities. When appropriate, statistical indices will be used to facilitate the understanding of the processes involved. Monitoring results will be continually reviewed to determine the advisability of changing the monitoring schedule. Recommendations for modifications to the EMP will be made, as needed, to the DOE. Such modifications may include the decrease/increase in some monitoring frequencies, the discontinuation of selected monitoring, and/or the addition of parameters to the monitoring schedule. Changes in the EMP will only be made with the concurrence of the DOE.

The majority of the raw data will be stored on commercially available spreadsheet programs, such as Lotus 1-2-3 and Excel. These spreadsheet packages also have the capability to reduce raw data into a more understandable format. Templates or macros created for each particular task will greatly enhance the speed and accuracy of the raw data reduction and analysis.

A variety of software graphics programs will be used to present the data. For the Macintosh computer system, Cricket Graph and Excel will be the most commonly used. Data stored on IBM-compatible personal computers will use the graphic capabilities of Lotus and Surfer.

7.4 Report Format, Content, and Frequency

Reports of environmental activities and results of the field test burns will be produced as part of the EMP. Written reports and other briefing materials will be prepared by EPT to document the results of each field test. These reports will address all pertinent results, findings, methodologies, analyses, and conclusions from the test burns. EPT will use these materials to conduct technical briefings for each of the six host utilities. EPT will also support and review the preparation of the overall project final report by providing write-ups on the field test results, as specified by the Project Manager.

CQ Inc., will be responsible for compiling the data received from EPT and preparing a quarterly report that addresses the monitoring specified in this EMP. Where a test series occurs during more than one quarter (e.g., testing starts at the end of one quarter and ends during the next quarter), CQ Inc., will report the results of the entire series during the later quarter or during the quarter where most of the testing occurred (at CQ's discretion). The objective is to avoid artificially breaking a test sequence report to meet the quarterly testing requirements. Contents of the report will include:

- A summary of plant operations and sampling results;
- A description of any deviations from the EMP;
- Details of the sampling and analytical procedures;
- An analysis of performance of pollution control units; and
- The results of all stream, ambient, and workplace sampling separated into compliance and supplemental monitoring.

Appendices will be included which contain the sampling and analytical data sheets, sampling and analytical methods summary, and Quality Assurance/Quality Control (QA/QC) information, i.e., QC procedures identified in Sections 9.1 and 9.2 and QA audits discussed in Section 9.4.

During test series or phased operation, quarterly and annual reports shall still be required. However, they will emphasize plant conditions and the types of sampling conducted during the reporting period rather than the results of the sampling. These reports will include:

- A description of project status;
- A summary of scheduled and completed sampling;
- A discussion of any regulatory compliance issues;
- A review of QA/QC activities during the period; and
- Copies of compliance reports submitted to regulatory agencies during the period.

If the facility is not operated in a phased or test series mode, then only quarterly and annual reports are required. These reports will contain the information outlined above for the test series reports. A separate fourth quarter and annual report are not required. The fourth quarter data will be included in the annual report.

Quarterly reports are due within 60 days of the end of the calendar quarter. Annual reports are due within 90 days of the end of the calendar year. Test series reports are due within 90 days following completion of the test series. DOE review and approval of these reports is not required.

8.0 REFERENCES

1. Coal Quality Development Center and Combustion Engineering. Volume II: Technical Proposal DE-PS01-86FE60966, Submitted to The U.S. Department of Energy and Electric Power Research Institute, June, 1989.

2. Energy and Environmental Research Corporation. Guidelines for Fireside Testing in Coal-Fired Power Plants: EPRI CS-5552. Prepared for Electric Power Research Institute, March, 1988.

3. Radian Corporation. Revised Final Environmental Information Volume, "Coal Quality Expert Project." Prepared for Coal Quality Development Center and Electric Power Research Institute, February 23, 1990.

4. Radian Corporation. *Draft Environmental Monitoring Plan Outline*, "Coal Quality Expert Project." Prepared for Coal Quality Development Center and Electric Power Research Institute, December 19, 1989.

5. Meeting with Mr. Richard E. Thompson of Fossil Energy Research Corp., May 14, 1990.

6. Telephone conversation with Mr. Buzz Hale of Kreisinger Development Laboratory, May 17, 1990.

7. Telephone conversation with Mr. Nick Sandru (Manager of Facilities and Quality Assurance) of Alliance Research Center, May 25, 1990.

8. Material received from Mr. Greg Clark of Alliance Research Center, May 22, 1990.

9. Telephone conversation with Mr. Jim Cool (Environmental Engineer) of Duquesne Light, May 25, 1990.

10. Telephone conversation with Mr. Hank Greenberg of Kreisinger Development Laboratory, July, 1990.

11. Material received from Mr. Greg Clark of Alliance Research Center, July 9, 1990.

12. Telephone conversation with Ms. Laurie Douglas, Industrial Hygienist with Homer City Power Plant, July, 1990.

13. Telephone conversation with Mr. Dave Lehman, Technical Support Superintendent of Plant Northeastern, July, 1990.

14. Telephone conversation with Mr. Brent Bailey, Industrial Hygienist with Plant Gaston, July, 1990.

15. Telephone conversation with Mr. Joe Broberg of Plant King, July, 1990.

16. Telephone conversation with Mr. Ronald Strelecki, Director of Health and Safety for Cheswick Power Station, July, 1990.

17. Telephone conversation with Mr. Ray Jackson, Environmental Specialist with Plant Watson, July, 1990.

9.0 QUALITY ASSURANCE

This section describes quality assurance activities to be performed by CQ Inc. to evaluate the adequacy of EPT's proposed test procedures and to ensure that these procedures are properly followed.

Definition of QA/QC

Quality assurance (QA) is defined as "all those planned or systematic actions necessary to provide adequate confidence that a product or service will satisfy given needs." Quality control (QC) is defined as "the operational techniques and activities which sustain a quality of product or service that meets the needs." [1] As a whole, QA/QC comprises routine procedures for controlling quality (QC) and independent assessment of the appropriateness of those procedures (QA).

In practice, quality control activities are those that are performed routinely by the persons directly involved in the work. The intent of the quality control activities for this measurement program is to ensure that the data produced are reliable. This objective is accomplished by establishing specific procedures for sample collection and handling, analysis, data validation and reporting, and recordkeeping. The role of quality assurance in this scheme is to review the routine procedures and determine if they are being followed and if they are adequate with respect to the overall objectives of the measurement program. Ultimately, the quality assurance role is one of accountability for the measurement program.

Fundamental to both quality control and quality assurance is corrective action. One objective of both QA and QC activities is to identify and correct any problems. Prompt communication and resolution of any problems are keys to a successful program.

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[1] Juran, J.M., Quality Control Handbook, 3rd Ed. McGraw Hill, 1974. Section 2.

Overview of the Quality Assurance Program

The logic behind the quality assurance program is to ensure that the combustion test program objectives are clearly defined, procedures are established for meeting those objectives, accountability for quality is assigned, and resources are allocated for achieving adequate quality.

For this program, quality objectives, control activities, and responsibilities will be described in test plans prepared by EPT for each combustion field test scheduled for six sites. Quality assurance activities conducted by CQ Inc. will include review of test plans, auditing of test program activities, and review of data reports. Based on their review, CQ Inc. may initiate action to ensure that the needs of the program are met.

Following review of the test plans, CQ Inc. may recommend changes or additions to the planned activities. Upon approval of each test plan, CQ Inc. will have an observer at the combustion tests to confirm that the tests are being conducted according to the plan. Thereafter, CQ Inc. will review the test reports for completeness and accuracy, initiate corrections if necessary, and ultimately validate the report.

9.1 Field Measurement and Sample Collection Plan

This section discusses quality considerations related to on-site process and emission measurements and collection of discrete samples to be submitted for laboratory analysis. These considerations are based on EPRI's Guidelines for Fireside Testing in Coal-Fired Power Plants,[2] hereafter referred to as the "Fireside Manual."

[2] Guidelines for Fireside Testing in Coal-Fired Power Plants, Prepared by Energy and Environmental Research Corporation, Irvine, California, for Electric Power Research Institute, Palo Alto, California, March 1988.

9.1.1 Sampling and Measurement Procedures

The objectives of the combustion test series should first be clearly defined in the test plans prepared by EPT. Then tests should be selected to fulfill the objectives. Wherever possible, reference (i.e., approved by a recognized authority such as EPA, ASTM, ASME, or EPRI) sampling and analysis methods should be selected to ensure consistency and repeatability when comparing test results from various studies. If non-reference methods are to be used, these should be described in sufficient depth to ensure their applicability to the test conditions.

Recommended sampling and process monitoring procedures are described in the Fireside Manual. Procedures for aqueous discharge sampling that are part of existing compliance monitoring programs have been approved by the State regulatory agencies and will be followed without significant modification. Grab samples of coal and ash will be collected using a laboratory scoop or sample thief. Details of compositing grab samples will be described in the test plans. Methods for measuring flue gas composition are described in the U.S. Code of Federal Regulations, Title 40, Part 60. Approved methods for planned sampling and analysis of gaseous streams are shown in Table 9-1.

9.1.2 Quality Control Procedures

Each test plan prepared by EPT should specify procedures that will ensure that the samples and data collected are reliable and defensible. To this end, the following procedures are recommended in the Fireside Manual.

- A test engineer should survey all test instruments for correct installation prior to conducting the test series;
- A portion of samples should be retained in the event that additional analyses are required;

TABLE 9-1. SAMPLING AND ANALYTICAL METHODS SUMMARY: GASEOUS STREAMS

Parameter	Sampling Method	Analytical Method
SO_2	EPA 6C	UV Absorption
CO	EPA 10	NDIR
CO_2	EPA 3A	NDIR
NO_x	EPA 7E	Chemiluminescent
O_2	EPA 3A	Micro Fuel-Cell
Particulate Loading	EPA 17	Gravimetric
SO_3	Controlled Condensation[a]	Titrimetric
Resistivity	In-situ Point-to-plane probe[a]	Electrometric

[a]J. L. Dubard and G. B. Nichols, "Electrostatic Precipitator Guidelines," EPRI RP 2243-1.

- Selected coal and ash samples should be sent to separate labs to ensure reproducible results;
- Data recordings made by observers during the tests should be periodically checked by a supervisor; and
- Periodic checks of critical test instrument calibrations should be made during the tests, depending on the duration of the tests and the desired level of measurement uncertainty.

Each test plan should specify the frequencies for collecting samples and taking instrument readings. These frequencies should be sufficient to ensure that the average of a set of values taken over the test period is representative of the actual test condition. The Fireside Manual recommends that individual instrument readings should not deviate by more than five percent from the average, or they should be investigated. If the deviation is not found to be related to an assignable cause that can be corrected, then the frequency of the readings should be increased.

9.1.3 Sample Preservation, Storage, and Transportation

Procedures for sample preservation, storage, and transportation should be described in the test plans. Considerations pertinent to these activities are discussed below.

Sample Preservation and Holding Times

Preservation techniques and reagent additions are used to prevent the loss of volatile parameters and sample degradation due to chemical changes. These procedures are conducted at or immediately following sample collection. Holding times which have been established should not be exceeded before analysis is initiated.

General holding times requirements for aqueous samples are shown in Table 9-2. Table 9-3 presents the requirements for coal and ash samples. Samples collected for analysis of moisture content, sulfur, and chlorine should be placed in air tight containers. When preservation reagents are added, samples of the preservative should be retained (and analyzed if contamination is suspected).

Sample Shipping

When any sample is to be shipped by common carrier or sent through the U.S. mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. Acid-preserved water samples do not need to be shipped as "corrosive" if, to the best of the shipper's knowledge, the water samples only have the acids (or bases), in allowable amounts, added to the samples for preservation and there are no other hazards associated with the water samples. The allowable amounts of acids and bases that can be added to the water samples are listed below:

Preservative	Allowable (wt. %)	Max Volume (mL Pres./L Sample)
Conc. HCl	0.04	1.0
Conc. HNO_3	0.15	1.5
Conc. H_2SO_4	0.35	2.0
10 N NaOH	0.08	2.0

Coal and ash samples are not considered hazardous materials and may be shipped unrestricted. If wet ice is used to keep samples cold during transportation, the ice should be double-bagged in zip-lock type plastic bags.

TABLE 9-2. SAMPLE PRESERVATION AND HOLDING TIMES FOR AQUEOUS SAMPLES

Parameter	Container Type[a]	Preservation	Holding Time
Hydrogen Ion (pH)	P,G	None	On-Site Analysis
Oil and Grease	G	Cool, 4°C	28 days
Total Suspended Solid	P,G	Cool, 4°C	7 days
Metals (except Cr VI and Hg)	P,G	HNO_2 to pH<2	6 months
Mercury	P,G	HNO_3 to pH<2	28 days
Cr VI	P,G	Cool, 4°C	24 hours
Alkalinity	P,G	Cool, 4°C	14 days
Specific Conductance	P,G	Cool, 4°C	28 days
Sulfate	P,G	Cool, 4°C	28 days
Nitrate	P,G	Cool, 4°C	48 hours

[a]P = plastic and G = glass.

TABLE 9-3. SAMPLE PRESERVATION AND HOLDING TIMES FOR SOLID SAMPLES

Parameter	Container Type[a]	Preservation	Holding Time
Ultimate Analyses Carbon Hydrogen Nitrogen Sulfur Oxygen	Plastic	None	--
Ash	Plastic	None	--
Moisture Content	Plastic	Store in absence of air	--
Sulfur	Plastic	Store in absence of air	--
Chlorine	Plastic	Store in absence of air	--
Higher Heating Value	Plastic	None	--

9.1.4 Documentation

An essential part of the sampling protocol is to ensure the integrity of the sample from collection to data reporting. This provides the ability to (a) trace the possession and handling of the sample from the time of collection through analysis and reporting; (b) specify preservation techniques and holding times to prevent parameter deterioration; and (c) reconstruct the sampling effort without reliance on the sampler's memory.

Samples and measurement data will be collected by various participants during this program. Each participant will be responsible for recording pertinent information related to each sample or measurement. It is recommended that a bound logbook or other suitable record be maintained by each participant to identify samples collected and chronological details of sampling efforts. Laboratory documentation, such as raw data, laboratory notes, chromatograms, strip chart recordings, standard curves, etc., should also be maintained for review.

In addition to data collected as part of existing compliance monitoring programs, the Fireside Manual presents the following guidelines for collecting supplemental monitoring data:

> Test data should be recorded on observation log sheets which include a space for the date, station name, unit number, test number, unit load, observer location, test value, instrument read, units, time of reading, and the observer's name and signature. Any corrections should be made by crossing out, entering the correct data, and initialing the change.
>
> If data loggers are used, then each test run should contain the date, time, instrument read, units, and values recorded. Back-up copies of data should be made as soon as possible to safeguard the test results.
>
> On completion of the test, copies of the observation log sheets should be made and retained by the Test Engineer and the generating station.

Adequate records should be maintained for all emission and process monitors to evaluate their functioning and performance including: (a) all calibration and calibration check records; (b) maintenance records; and (c) data records.

Sample Labels

To identify the source, time or time span of sample collection, and to prevent misidentification, sample labels should be affixed to sample containers prior to or at the time of collection. The sampler should enter the following type of information on the label using waterproof ink:

- Test or condition number;
- Date and time (or time span) of collection;
- Sample location;
- A unique sample identification number (in some cases, samples may be identified using date and time of collection);
- Field information that may impact the sample analysis (e.g., analysis request, sample 1 of 2, hold, etc.).

Field Log Books

A bound log book(s) or other suitable record should be used to document information pertinent to the sampling effort and to identify samples and document their source. The following type of information should be recorded at the time of the sampling activities:

- Sample identification number;
- Date, time, test number, and sample source;
- Any QC samples, such as field blanks or duplicates;
- Sample compositing information;
- Source of any preservatives used; and
- Conditions or observations that might affect results.

A good rule to follow is to record enough information so that someone can reconstruct the sampling effort without reliance on sampler's memories.

Sampling Tracking

Samples transferred for off-site analysis should be properly packaged for shipment with a sample tracking form attached or included in the package. The form should identify, at a minimum, the samples submitted, analyses requested, and any special instructions. Copies of the sample tracking forms should be maintained by the originators.

9.2 Laboratory Analysis Plan

EPT's test plans should include details of laboratory analysis, specifically the analytical methods to be used. As with sampling and on-site measurements, the test plan should cite reference methods, i.e., those approved by authoritative sources, or provide a detailed description of the method to be used if an appropriate reference method is not available.

The test plans should specify the laboratories to be used and describe provisions for ensuring that the data produced are of adequate quality. In this context, EPT will serve in a quality assurance function for the laboratories that they select to perform the analyses. EPT will determine that the laboratories selected perform routine quality control activities that are adequate for the needs of the program.

9.2.1 Analytical Methods

A list of reference methods for analysis of coal, bottom ash, and fly ash is shown in Table 9-4. These or comparable methods should be cited in the site-specific test plans. Any modifications to the reference methods or use of special tests should be described in detail in the test plans.

9.2.2 Quality Control Procedures

Analytical quality control requirements relate to adherence to standardized procedures with periodic analysis of control samples to monitor performance. Frequencies for instrument calibrations and standardizations, as well as analysis of control samples, including blanks, duplicates, and spikes, should be followed as specified in the published methods or should be consistent with approved practices in each laboratory involved.

TABLE 9-4. SAMPLING AND ANALYTICAL METHODS SUMMARY: SOLID STREAMS

Parameter/Test	*Sampling Method*	*Analytical Method*
Raw Coal	Scoop	
Proximate Analysis		ASTM D3172
Ultimate Analysis		ASTM D3176
Calorific Value		ASTM D3286
Mineral Ash		ASTM D4326
Ash Fusion		ASTM D1857
Grindability		ASTM D409
Coal Flow (mass)	None	Plant Instrumentation
Bottom Ash	Scoop	
Carbon Content		ASTM D3178[a]
Sulfur Content		ASTM D4239
Fly Ash	Scoop	
Carbon Content		ASTM D3178[a]
Sulfur Content		ASTM D4239
Particle Sizing		Cascade Impactor[b]

[a]A new analytical method known as LECO CHN may be substituted for ASTM D3178. This new method surpasses the ASTM quality standards.

[b]D. B. Harns, "Procedures for Cascade Impactor Calibration and Operation in Process Streams," EPA Report 600/2-77-004.

In selecting laboratories, EPT should verify that each laboratory can provide assurance that the measurement data produced are technically sound. To ensure reliable interpretation of the data, EPT should also be able to document the precision and accuracy of the measurement data and, if applicable, demonstrate the extent of significant background (blank) contribution to the measurement result. Laboratory quality control procedures that pertain to measurement uncertainty evaluation are described below.

Precision

Replicate analyses and analysis of replicate samples represent mechanisms for evaluating measurement data variability, or precision. Replicate analyses are used to monitor analytical replicability, the results of which provide immediate feedback to the analyst and are used to control the precision of the analytical process. Results for replicate samples may be used to define the total variability of the entire sampling/analytical system, but are not used as a control mechanism.

Accuracy

Accuracy is the degree to which a measured value agrees with the true value for a given parameter. Accuracy for a single measurement includes components of both precision and bias. Bias is a systematic error that results in a constant error in a positive or negative direction, and may be estimated as the average of a large number of accuracy statistics. In such a case, the random variability component is "averaged out", leaving only the bias. The purpose of calibration is to eliminate or minimize bias.

The ability to produce accurate results may be demonstrated through equipment calibration checks, analysis of control and spiked samples, and analysis of QA audit samples. Extrapolation of audit and QC data to actual samples and measurements provides the mechanism by which error limits for various measurements may be estimated and the confidence in the measurement data defined.

9.2.3 Data Validation

Data should be first validated by the responsible laboratory before it is reported. This validation should be based on acceptable calibration and method performance checks. As a quality assurance function, EPT should verify that the validation mechanisms used by the laboratories are appropriate. EPT will further review all data for reasonableness and completeness. Thereafter, CQ Inc. will assume final authority to validate the data reports before they are used in the program evaluation. In reviewing the test plans, CQ Inc. should be satisfied that the data will have been systematically reviewed prior to being submitted.

9.2.4 Documentation

Raw data and records related to measurement quality should be maintained by the organization producing them. These include all raw data sheets, observation logs, calibration records, QC sample analysis results, and instrument printouts. The test plans should detail any plans to archive copies of the raw data in a single location.

9.3 Data Reporting Plan

Details of information management and reporting are described in Section 7 of this EMP. A brief discussion of report contents recommended in EPRI's Fireside Manual and the plan for reviewing the reports is presented below.

9.3.1 Report Contents

EPT's test plan should specify what information is to be reported. To ensure completeness, facilitate comparability between researchers, and encourage international exchange of information, EPRI's Fireside Manual recommends using the following report format as a guide:

Executive Summary
Section 1. Introduction
Section 2. Test Program
    Description of Equipment
    Description of Test Program
- Test Scope
- Test Personnel
- List of Instruments
- Test Schedule

Section 3. Test Results
    Equipment Performance Observations
    Data
    Analysis
Section 4. Discussion of Results
Section 5. Conclusions
Appendices

Additional details of this report format are presented in the Fireside Manual. Significant details of the planned report should be presented in EPT's test plans for the sake of review by CQ Inc. Adequate planning of the test reports ensures that appropriate information will be collected during the tests and helps to identify potential deficiencies.

9.3.2 Report Review

Each test report submitted by EPT will be reviewed by CQ Inc. EPT will be notified of any deficiencies or concerns. A final report will be issued based on approval by CQ Inc.

9.4 Quality Assurance Audits

The purpose of quality assurance audits is to provide objective, independent assessments of measurement efforts. They ensure that data generation, data gathering, and measurement activities produce reliable and useful results. In some cases, inadequacies may be identified in the measurement system. In such cases, audits provide a mechanism for implementing corrective action. Two types of quality assurance audits are technical systems audits and performance evaluation audits.

A technical systems audit is an on-site, qualitative review of the various aspects of a total sampling and/or analytical system. It is an assessment of overall effectiveness. It represents a subjective evaluation of a set of interactive systems with respect to strengths, deficiencies, and potential areas of concern. Typically, the audit consists of observations and documentation of all aspects of the measurements. Audits involve questions regarding:

- Calibration procedures and documentation;
- Completeness of reporting requirements;
- Data review and validation procedures;
- Data storage, filing, and recordkeeping procedures;
- Sample tracking procedures;
- Quality control procedures and documentation;
- Operating conditions of facilities and equipment;
- Documentation of maintenance activities; and
- Systems and operations overview.

Detailed systems audit checklists are useful to delineate the critical aspects of each methodology or activity, and serve to document audit observations. The critical aspects and criteria should be based on the intended use of the data, i.e., the audit expectations should be tailored to the needs of the program, neither over-designed nor under-designed.

The purpose of a performance evaluation audit is to quantitatively assess the quality of the measurement data. Such an audit provides a direct evaluation of the capabilities of the various measurement systems to generate quality data. This is accomplished by challenging the measurement systems with accepted reference standards.

Useful performance evaluation samples for this program would include materials such as NBS coal and fly ash standards submitted blind to the laboratory. For continuous emission monitors, cylinder gas audits using EPA Protocol 1 or other certified test gases are appropriate. The use of performance evaluation samples other than those analyzed as part of routine laboratory certification activities is the responsibility of EPT. It is recommended that performance evaluation samples be submitted as early in the program as possible so that any problems can be identified and addressed promptly.

The most important aspect of systems and performance audits is to implement corrective action where warranted. Any problems identified during the audits should be documented and communicated to the appropriate parties. The outcome of the problem, including any corrective action taken, should be documented.

9.4.1 Audit Approach

In addition to audits conducted by regulatory agencies as part of each facility's operating permits, quality assurance systems audits of combustion test activities will be conducted by CQ Inc. EPT will be responsible for conducting systems and performance audits of laboratories they select and will report the results of their audits.

During each combustion test series, CQ Inc. will have an auditor on site to observe selected procedures and confirm adherence to the test plan. If any problems are identified, the auditor will notify the EPT and CQ Inc. supervisors, make recommendations for corrective action, verify that the problems are resolved, and submit an audit report to the CQ Inc program manager.

9.4.2 Recommendations for Corrective Action

Recommendations for corrective action will be communicated verbally to the EPT and CQ Inc. supervisors and subsequently documented. This *should be done as soon as the problem is identified and should include a* detailed description of the problem, the level of urgency, and the expected impact of not resolving the concern.

9.4.3 Verification of Correction Action

The auditor will verify that any identified problems have been resolved and will include this in the audit report. If it is not feasible to correct the situation or a modification to the plan is justified, the EPT and CQ Inc. supervisors will be advised and will decide on the appropriate action.